

**EPA Superfund  
Record of Decision:**

**MALVERN TCE  
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SUPERFUND PROGRAM  
RECORD OF DECISION

<IMG SRC 98011A>

Malvern TCE Superfund Site  
Malvern, PA  
Chester County, Pennsylvania  
November 1997

#### DECLARATION

##### SITE NAME AND LOCATION

The Malvern TCE Superfund Site  
East Whiteland Township, Chester County, Pennsylvania

##### STATEMENT OF BASIS AND PURPOSE

This decision document presents the final selected remedial action for the Malvern TCE Superfund Site (Site). The remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the Site.

The Commonwealth of Pennsylvania concurs with the selected remedy.

##### ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, I hereby determine pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, that actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to the public, health, welfare, or environment.

##### DESCRIPTION OF SELECTED REMEDY

The selected remedy described below is the only planned action for the Site. This remedy addresses an alternate water supply, capping of soils and groundwater remediation at the Main Plant Area, excavation and off-Site treatment and disposal of contaminated soils at the Former Disposal Area, and Natural Attenuation of groundwater at the Former Disposal Area.

The selected remedy includes the following major components:

- 1) Water Supply: Installation of a waterline to prevent contact with groundwater contamination at residences affected or potentially affected by the Site.
- 2) Main Plant Area Soils: Installation of a cap to prevent direct contact with contaminated soils at the Main Plant and to reduce the potential for continued migration of these contaminants to the groundwater.

- 3) Main Plant Area Groundwater Plume: Extraction and treatment of groundwater via air stripping followed by carbon adsorption or U/V oxidation and subsequent reinjection of treated water to the aquifer to restore the Site groundwater to beneficial use.
- 4) Former Disposal Area/Mounded Area Soils: Excavation, off-Site treatment and disposal of contaminated soils to reduce the potential for continued migration of contaminants in these soils to the groundwater.
- 5) Former Disposal Area/Mounded Area Groundwater Plume: Implementation of a Natural Attenuation program to monitor reduction of contaminant concentrations in groundwater to Maximum Contaminant Levels.

#### STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment and is cost effective. EPA believes that the selected remedy will comply with all Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action. The selected remedy utilizes a permanent solution to the maximum extent practicable and satisfies the statutory preference for a remedy that employs treatment that reduces toxicity, mobility, or volume.

Because this remedy will result in hazardous substances remaining on-Site above health-based levels, a review by EPA will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

<IMG SRC 98011B>

MALVERN TCE SUPERFUND SITE

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## MALVERN TCE SUPERFUND SITE

### RECORD OF DECISION

#### MALVERN TCE SITE

#### PART II - DECISION SUMMARY

##### I. SITE NAME, LOCATION, AND DESCRIPTION

The Malvern TCE SuperFund Site (Site) is located in East Whiteland Township, Chester County, Pennsylvania (Figure 1). The Site is owned and operated by Chemclene Corporation (Chemclene), which presently sells hydraulic oil and industrial cleaning solvents from the 258 North Phoenixville Pike location. The Site encompasses approximately 5 acres along the southeast side of Bacton Hill, and includes a Main Plant Area connected to a Former Disposal Area by a narrow meadow corridor. A Transcontinental natural gas pipeline right-of-way extends along the southern boundary of the Site, with residential areas and areas with natural forestation and vegetation bordering the property to the west north and east (Figure 2).

Existing facilities at the main plant include a former distillation building, a storage building which has collapsed, a concrete pad area, an open garage, and seven above-ground storage tanks (Figure 3). One 8,000-gallon tank contains hydrogen peroxide and the other six above-ground storage tanks are currently empty. From 1952 until 1992, Chemclene Corporation sold and reclaimed industrial cleaning solvents including trichloroethene (TCE); 1,1,1-trichloroethane (1,1,1-TCA); perchloroethylene (PCE, also called tetrachloroethene); and methylene chloride (MEC). These solvents were used by local industries for degreasing metal parts and other cleaning purposes. Chemclene used a distillation process to remove impurities from the chlorinated solvents. The distilled solvents were then returned to customers for reuse.

The end products of processing waste solvents are the reclaimed solvents and chlorinated still bottoms. The chlorinated waste solvents are listed hazardous wastes pursuant to the Resource Conservation and Recovery Act (RCRA) and therefore, the resulting still bottoms are listed hazardous waste. Prior to 1976, Chemclene reportedly buried drums containing the still bottom sludges from the distillation process in the Former Disposal Area and Mounded Area, approximately 1,900 feet southwest of the main plant. The Former Disposal Area consists of two unlined earthen pits, each approximately 30 feet by 50 feet by 15 feet deep. This area is currently secured by an 8-foot high chain link fence. The Mounded Area, located on the western edge of the Former Disposal Area, is approximately 8 feet wide by 150 feet long.

##### II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

In the spring of 1980, TCE was detected in groundwater from several wells in the vicinity of the Chemclene facility. At this time, Chemclene Corporation began sampling domestic wells in the immediate vicinity of the property. Private domestic wells and on-Site monitoring wells were sampled by Pennsylvania's Department of Environmental Resources (PADER) and Chemclene in June 1980 and July 1981. Analytical results revealed contamination of the underlying aquifer with chlorinated ethenes and related compounds. TCE was detected in wells at concentrations up to 12,600 micrograms per liter (ug/l), far exceeding the Maximum Contaminant Level (MCL) of 5.0 ug/l. The Site was listed on the National Priorities List (NPL) in September 1983. The contaminated home wells were located south of the Former Disposal Area, with several located in the Hillbrook Circle residential development. Chemclene furnished activated carbon filter units to 20 residential wells within the Hillbrook Circle Development and conducted periodic sampling of home wells in accordance with its Domestic Well Management Plan until November



1994. In February 1995, EPA assumed control of maintenance activities of the carbon filter units and periodic sampling of the home wells, after it was determined that Chemclene was not following the procedures outlined in its Domestic Well Management Plan. In August 1995, several of the filter systems were upgraded by EPA in response to analytical results from residential well samples that showed contamination was passing through the existing filters into the homes.

In addition to the installation of carbon filters, Chemclene conducted removal actions following the detection of soil and groundwater contamination in 1980. Debris and approximately 300 drums were removed from the Former Disposal Area excavations in a prolonged remedial effort from 1981 to 1984. Soils underlying the Former Disposal Area were excavated to a depth of 15 feet and transported for disposal at a RCRA permitted disposal facility. Additional drums were removed from the Mounded Area in late 1990; however, contaminated soil was left in place.

Four underground storage tanks (USTs) were removed from the main plant in 1986. Soil samples collected from below the excavation grade of the tanks exhibited elevated concentrations of TCE, PCE, and 1,1,1-TCA. In addition, elevated levels of volatile organic contaminants (VOCs) were detected in soil gas samples collected outside the distillation building in the Main Plant Area. These contaminant levels are believed to be related to Chemclene's past practices of discharging contaminated condensate from the recycling distillation process directly onto the ground surface.

As an operating facility, Chemclene Corporation entered into a Corrective Action Order with EPA in 1987. A RCRA Facilities Investigation (RFI) Work Plan was approved for the Site in 1989. In July 1992, Chemclene withdrew its RCRA Part B Application as a treatment and storage facility, and stopped accepting waste solvents for reclamation. Chemclene continues to operate a hauling operation and sells hydraulic fluid, raw TCE, and hydrogen peroxide from the Site. This operation is regulated by the East Whiteland Township Fire Marshal's office.

Chemclene failed to complete the RCRA RFI and implement interim corrective measures. As a result, EPA began considering the Site under the Superfund remedial program in November 1993. All existing data was compiled and a report was developed entitled Data Summary Report, April 1995. Based on EPA's review of the existing information, data gaps were identified and EPA conducted a Remedial Investigation (RI) to complete the necessary data gathering at the Site. The RI was completed in January 1997 and the Feasibility Study (FS) in June 1997. The Proposed Plan for a comprehensive Site clean up was issued in June 1997.

### III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The documents which EPA used to develop, evaluate, and select a remedy for the Site have been maintained at the Chester County Library, 400 Exton Square Parkway, Exton, PA and at the EPA Region 3 Office, Philadelphia, PA.

The Proposed Plan was released to the public on June 23, 1997. The notice of availability for the RI/FS and Proposed Plan was published in the Daily Local News on June 23, 1997. A 30-day public comment period began on June 23, 1997 and was initially scheduled to conclude on July 23, 1997. By request, the public comment period was extended until September 2, 1997.

A briefing for the East Whiteland Township Board of Supervisors and a public meeting were held during the public comment period on July 14, 1997. At the meeting, representatives from EPA answered questions about the Site and the remedial alternatives under consideration. Approximately 50 people attended the meeting, including residents from the impacted area, potentially responsible parties, and news media representatives. A summary of comments received during the comment period and EPA's responses are contained in Part III of this

document.

#### IV. SCOPE AND ROLE OF RESPONSE ACTIONS

This final selected remedy addresses the threats posed by the release of hazardous substances at the Site. The primary objective of the remedy described in this ROD is to reduce or eliminate the potential for human or ecological exposure to contaminated soil and groundwater at the Site. The selected remedy outlined on pages 52 to 64 of this ROD will comprehensively address the risks posed by the release or threat of release of hazardous substances from the Site. The concentrations of chemicals in the two groundwater plumes exceed the MCLs set under the Safe Drinking Water Act, 42 U.S.C. §§ 300(f) to 300(j-26). In addition, this remedial action addresses soils at the Former Disposal Area.

#### V. SUMMARY OF SITE CHARACTERISTICS

##### A. Topography

The Site is located in eastern Chester County, Pennsylvania, in the Piedmont Physiographic Province of the Appalachian Highlands. Topography in the county is characterized by uplands composed of Precambrian igneous and metamorphic crystalline rocks that have weathered into rolling hills. These uplands are bisected by the Chester Valley, the county's most prominent topographic feature, which is underlain by deeply eroded carbonate rocks. The Chester Valley trends east/northeast across the county.

The Site is situated in the northern edge of the Chester Valley adjacent to Bacton Hill. The valley floor has gentle relief with elevations ranging from 350 to 400 feet above mean sea level (MSL). Topography at the Site ranges from 395 feet MSL in the north portion of the Former Disposal Area to 360 feet MSL in the area around the main plant. Bacton Hill defines the north edge of the valley around the Site and is underlain by the Cambrian age Chickies Quartzite, a formation that is comparatively resistant to weathering and forms ridges.

##### B. Climate

The climate in Chester County is humid, temperate and continental with fairly mild winters. Average monthly temperatures range from 32°F in January to 77°F in July (National Oceanic and Atmospheric Administration, Climatological Data from Conshohocken Station). The average annual temperature, based on a 100-year record through 1955 is 52.25°F. The absolute minimum and maximum temperatures for the same time period are -15°F and 105°F respectively.

Precipitation in Chester County is evenly distributed throughout the year, with a difference of about 1.2 inches between the wettest month (July) and the driest month (October). Most of the rainfall in the warm seasons occurs as showers and thunderstorms. An average of thirty storms occur each year, producing considerable erosion and local flooding when infiltration capacity is exceeded and surface drainage systems are near maximum capacity. Flooding problems are exacerbated by the increase in impermeable surfaces associated with commercial development of the area. The average annual groundwater recharge to underlying carbonate rocks in the Chester Valley is 21 inches, approximately 45 percent of the total precipitation.

The average amount of snow falling on Chester County ranges from 20 to 30 inches per year, but usually remains as ground cover only for several days per year. During winter months, precipitation events are usually more prolonged and less intense than in the summer. Runoff is reduced in the winter and groundwater recharge is enhanced, unless the ground surface is frozen.

Lower winter temperatures reduce evaporation and plants become dormant, greatly reducing water losses through transpiration.

### C. Hydrology

The Site is located in the Chester Valley, underlain by carbonate and clastic rocks of Cambrian and Ordovician age. The immediate area of the Site is underlain by the Ledger Dolomite and Elbrook Limestone Formations. Recent overburden deposits across the Site consist of fine-grained soils overlying bedrock. Overburden deposits range in thickness from 30 to 120 feet.

The bedrock aquifer underlying the Site is generally unconfined and is recharged by local precipitation. Groundwater flows through a network of interconnected secondary openings that include joints, faults, bedding planes, and fractures. In May 1996, the mean depth to groundwater at the Main Plant Area was 70 feet.

Groundwater at the Main Plant Area flows to the northeast toward the Catanach Quarry at a gradient of 0.02 ft/ft. The regional potentiometric surface shows that there is a groundwater divide located between the Main Plant Area and the Former Disposal Area near monitoring well CC-11. Water level data suggests that the divide may move as a function of quarry activity and hydrogeologic conditions. Based on the hydraulic gradient and coefficients of hydraulic conductivity derived from the results of aquifer tests at monitoring wells CC-19 and CC-21, groundwater flows at a relatively rapid velocity of 0.66 ft/day.

Groundwater beneath the Former Disposal Area/Mounded Area flows to the southwest toward the Hillbrook Circle development under a relatively flat gradient (0.001 ft/ft). Groundwater velocities range up to 5 ft/day. (See Figure 4)

This aquifer is a current drinking water source. As recently as 1992, the Philadelphia Suburban Water Company withdrew water from this aquifer at a production well on Phoenixville Pike to supply local residents on public water. In addition, Great Valley High School operated a well in the Ledger Aquifer to provide water for drinking and irrigation.

### D. Land Use

The predominant land uses in East Whiteland Township are open space, encompassing 32 percent of total township acreage, and single-family residences and agriculture, each making up approximately 14 percent. Much of the open area consists of forested uplands and meadows. Open space and agricultural lands have been decreasing since 1950, as the percentage of commercial and residential land increases.

## VI. NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature and extent of contamination in the soils (surface and subsurface), groundwater, and surface water and sediment at the Site. This discussion is presented by area: Main Plant Area, Former Disposal Area/Mounded Area, and Potential Disposal Area. Within each of these areas, the media (soil-surface and subsurface, groundwater, surface water and sediment) is then discussed. Domestic well data are presented in the subsection discussing groundwater contamination at the Former Disposal Area/Mounded Area.

### A. Main Plant Area (MPA)

#### SURFACE SOIL

Twenty-five surface soil samples were collected at the Main Plant Area in the spring of 1996.

Samples were collected from 0 to 6 inches. Samples were collected from background locations (SS-1, SS-2, and SS-41 through SS-44) and in areas of suspected contamination based on the results of previous investigations. These areas include the loading dock area (SS-4 through SS-6); the former UST area (SS-3, SS-7 through SS-9); the existing above-ground storage tank area (SS-10 through SS-16); and the fill area west of the storage building (SS-17 through SS-20).

#### Volatile Organic Compounds (VOCs)

VOCs detected in the surface soils were comprised mostly of chlorinated aliphatic hydrocarbons (CAHs) including: 1,2-dichloroethane (1,2-DCA), total 1,2-dichloroethene (total 1,2-DCE), MEC, PCE, 1,1,1-TCA, and TCE. Figure 5 shows the contaminant distribution of VOCs for the surface soil samples collected at the Main Plant Area and indicates where Soil Screening Levels (SSLs) were exceeded. Acetone and MEC were detected in some samples at concentrations not substantially above levels detected in laboratory quality control blanks. Excluding these data, VOCs were detected in 13 of the 25 surface soil samples collected at the Main Plant Area.

Total VOC concentrations range from 2 ug/kg to 235 ug/kg (SS-07). TCE was detected in 7 samples with concentrations ranging from 2 ug/kg (SS-08) to 81 ug/kg (SS-07). PCE was detected in 12 samples with concentrations ranging from 2 ug/kg to 56 ug/kg (SS-12). MEC was detected in all 25 surface soil samples collected at the Main Plant Area. Of the 25 samples, only one, SS-07 (80 ug/kg), was detected at a concentration substantially above the level detected in the laboratory quality control blank. Table 1 lists the maximum concentrations of contaminants detected in the surface soil at the Main Plant Area. See Figure 5 for distribution of VOCs in surface soil.

VOC screening levels were exceeded in the surface soil for 1,2-DCA, MEC, PCE and TCE at concentrations of 24 ug/kg, 80 ug/kg and 81 ug/kg, respectively.

#### Semivolatile Organic Compounds (SVOCs)

Eighteen SVOCs were detected in the surface soils at the Main Plant Area. SVOCs were detected in 15 of the 25 surface soil samples collected at the Main Plant Area at concentrations substantially above the laboratory quality control blanks. Total SVOCs concentrations range from 11 ug/kg (SS-10) to 11,103 ug/kg (SS-11) (Figure 6). The total SVOC concentration of 11,103 ug/kg detected at SS-11 is comprised mainly of bis(2-ethylhexyl) phthalate at 11,000 ug/kg. Fifteen SVOCs were detected in the sample SS-15, collected adjacent to the aboveground storage tank area. Total SVOC concentrations for SS-15 were 8,660 ug/kg. Excluding bis(2-ethylhexyl)phthalate, no SVOC was detected in more than 7 of the 25 samples collected. Figure 6 also shows the distribution of the SVOCs in the surface soil at the Main Plant Area, and indicates samples where criteria have been exceeded.

#### Inorganics

Twenty-two inorganics (total metals and cyanide) were detected in the surface soils in the Main Plant Area. Eighteen metals were detected in 19 or more of the surface samples collected at the Main Plant Area. The highest concentrations of nine metals were detected at SS-17, in the fill area adjacent to the rear storage building. Table 1 presents the maximum concentrations detected in the surface soil at the Main Plant Area.

Concentrations of metals in the background samples (SS-1, SS-2, SS-41, SS-42, SS-43, and SS-44) were comparable to Main Plant Area samples SS-3 through SS-20. SSLs were exceeded for barium, chromium, nickel and thallium in the surface soils. Twenty-three surface soil samples with concentrations up to 140 mg/kg, exceeded the SSL (32 mg/kg) for barium. Nineteen samples with concentrations up to 113 mg/kg exceeded the SSL (19 mg/kg) for chromium. SSLs were exceeded in 10 samples for nickel and in one sample for thallium. The pervasive appearance of barium and

chromium in all the samples, including background samples, indicates these metals may occur naturally in the surface soil at the Main Plant Area.

Elevated iron and manganese concentrations in soil are not considered to originate from the waste disposal activities at the Main Plant Area. Most of the subsurface soil at the Site is stained brick-red to red-brown, indicating that the soil contains percentage amounts (of the bulk mineral matrix) of ferric hydrous oxide minerals. This type of soil is common world-wide in mature carbonate terrains and is not related to contamination by synthetic organic compounds.

Concentrations of iron and manganese in soil will decline in the presence of significant amounts (greater than 1.0 mg/l) of Site-related contamination. Anaerobic bacteria utilize iron and manganese as electron acceptors in the degradation of CAHs and aromatic hydrocarbons. Often, in soil extensively contaminated with VOCs and SVOCs, iron and manganese hydrous oxides have been completely leached away leaving a reduced mineral assemblage. Soil color is usually altered from red-brown to dark-gray.

#### SUBSURFACE SOILS

Twelve soil borings were installed in the spring of 1996 at the Main Plant Area (Figure 7). The total depth of the soil borings ranged from 42 feet to 102 feet. Overburden deposits range in thickness from approximately 30 feet (CC-6) to greater than 100 feet (MPA-8, MPA-9). Overburden deposits consists of reddish brown and whitish-gray silts and sands interbedded with clays, silty clays and clayey silts. Gravel and pebble size limestone/dolomite clasts are found throughout the overburden deposits. Silt and sand lenses beneath the Main Plant Area range in thickness from less than 1 foot up to 40 feet (MPA-8 and MPA-9).

Forty subsurface soil samples were collected for laboratory analysis from 12 borings at the Main Plant Area. Samples were collected from 2-foot intervals in each boring.

#### Volatile Organic Compounds

VOCs detected in the soil samples collected at the Main Plant Area included: 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), Total 1,2-DCE, 1,2-DCA, 1,1,1-TCA, TCE, 1,1,2-TCA, 1,1,2,2-tetrachloroethane (1,1,2,2-PCE), PCE, total xylene, toluene, ethylbenzene, benzene, 2-butanone, 4-methyl-2-pentanone. VOCs considered as possible laboratory contaminants included MEC, acetone, and chloroform. TCE was detected in 22 of the samples ranging in concentrations from 1 to 420,000 ug/kg (MPA-8, at 25-27 foot depth). Total 1,2-DCE was detected in 13 of the samples ranging in concentrations from 1 to 4,000 ug/kg (MPA-6 at 10-12 foot depth). PCE was detected in 12 samples from 2 to 270,000 ug/kg MPA-6, 10-12 feet depth). Table 2 outlines the maximum concentrations detected in the subsurface soil at the Main Plant Area, and the location of the highest detection by parameter.

In borings MPA-1, MPA-11 and MPA-12, designated as background borings, TCE was only detected (3 ug/kg) in the 10-12 foot sample at MPA-1. Borings MPA-2 and MPA-3 are located in the loading dock area where distillate condensate was reportedly disposed onto the ground surface. Low levels of TCE, PCE and 1,1,2-TCA were detected in MPA-3. Generally, VOC concentrations increased (by 1 to 2 orders of magnitude) with depth at MPA-2. Total VOCs were detected at 1277 ug/kg in the MPA-2 at the 50-52 foot depth interval. MEC data were flagged as possibly resulting from laboratory contamination in each of the samples were detected, at concentrations up to the maximum of 480 mg/kg in MPA-2 at the 50-52 foot depth.

Borings MPA-4, MPA-5, MPA-6, and MPA-7 are adjacent to the former UST area. Low levels of VOCs (<20 ug/kg) were detected in MPA-5. Moderate levels of VOCs were detected in samples from MPA-4 and MPA-7. Total VOCs at MPA-7 were detected at less than 100 ug/kg in both samples. Total VOCs

in MPA-4 at the 12-14 foot depth were detected at 260 ug/kg, and at lower concentrations in the other samples. VOCs were detected in MPA-6 in the 10-12 foot sample at 497,316 ug/kg, including total benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations of 152,052 ug/kg, and PCE at 270,000 ug/kg. The highest concentrations for nine VOCs at the Main Plant Area were detected in MPA-6 at the 10-12 foot interval, which corresponds to the base of the former USTs excavations. Seven VOCs from this sample exceeded screening levels.

Borings MPA-8 and MPA-9 are adjacent to the above ground storage tank area. Moderate to high levels of VOCs were detected in MPA-8 at the 25-27 foot depth and MPA-9 at the 100-102 foot depth. Total VOCs detected in MPA-9 at the 100-102 foot depth were at concentrations of 869 ug/kg, with TCE as the main component at 780 ug/kg. MEC was also detected in MPA-9 samples at concentrations up to 140 ug/kg. Total VOCs were detected in NWA-8 at the 25-27 foot interval at concentrations of 625,214 ug/kg, with TCE as the main component at 420,000 ug/kg.

Boring MPA-10 is adjacent to the storage shed. Moderate levels of VOCs were detected in the MPA-10, 6-8 ft. sample at concentrations of 871 ug/kg, with total xylene as the main component at 780 ug/kg. NEC was also detected in MPA-10 at the 6-8 foot interval at 160 ug/kg.

#### Semivolatile Organic Compounds

Twenty-one SVOCs were detected in the subsurface soil samples at the Main Plant Area. The distribution of SVOCs varied significantly with most SVOCs being present in five or fewer samples. Of the maximum detected concentrations for the SVOCs in the Main Plant Area, eighteen were detected in the MPA-6 at the 10-12 foot interval. The total SVOC concentration in this sample is 18,070 u.g/kg. Only the bis(2-ethylhexyl) phthalate concentration exceeded the soil screening level. The SVOCs detected are constituents of petroleum hydrocarbons and probably originated from one of the USTs. Table 2 outlines the maximum concentration detected and the number of times each analyte was detected.

#### Inorganics

Twenty-one inorganics (total metals and cyanide) were detected in the subsurface at the Main Plant Area. Sixteen metals were detected in 34 or more samples. Table 2 outlines the maximum concentration detected and the number of times each analyte was detected.

SSLs were exceeded for arsenic, barium, chromium, and nickel in subsurface samples at the Main Plant Area. The SSL for barium (32 mg/kg) was exceeded in eleven samples with concentrations up to 287 mg/kg. Seven subsurface samples exceed the SSL for nickel (21 mg/kg) with concentrations up to 62.3 mg/kg. The SSL for chromium was exceeded in four samples and the SSL for arsenic was exceeded in one sample.

#### GROUNDWATER

A groundwater sampling program was conducted in the spring and winter of 1996 to determine the nature and extent of contamination in the groundwater at the Main Plant Area (See Figure 8 for monitoring well locations). This subsection describes the known horizontal and vertical extent of contamination in the groundwater beneath the Main Plant Area. Groundwater contamination is defined by analytical results from a monitoring well sampling event in May 1996, and a time-related sampling during 24-hour aquifer tests at CC-19 and CC-21.

Five existing and four newly-installed monitor wells and one commercial well (CC-JO) were sampled in the spring and winter of 1996. Eleven samples were collected and analyzed for organics, metals (total and dissolved), cyanide, and water quality parameters from CC-2, CC-3, CC-6, CC-7, CC-13, CC-19, CC-20, CC-21, CC-22 and CC-JO. Table 3 and 4 highlight parameters

where MCLs have been exceeded in the groundwater for organics, and total and dissolved inorganics.

#### Volatile Organic Compounds

Twenty-three VOCs were detected in the groundwater monitoring wells at the Main Plant Area with the number of VOCs detected in each well ranging from six to seventeen. VOCs were not detected in the Led-Jo commercial well (CC-JO). Sixteen VOCs were detected in the groundwater at CC-06 and CC-07. The primary contaminants disposed at the Main Plant Area, 1,1,1-TCA, TCE and PCE, were detected in all monitoring wells. The maximum detected concentrations for nine VOCs were detected at CC-06, and maximum detected concentrations for ten VOCs were detected at CC-07. Total VOCs detected at the Main Plant Area range in concentration from 20 ug/l (CC-20) up to 88,732,ug/l (CC-6). Total VOCs detected at CC-07 were 59,881 ug/l. Figure 8 shows the distribution of VOCs and SVOCs in groundwater at the Main Plant Area, including compounds that exceeded MCLs.

Primary MCLs were exceeded for eleven VOCS including: 1,1,1-TCA, 1,1,2-TCA, 1,1-DCE 1,2-DCA, carbon tetrachloride, chloroform, cis-1,2-DCE, MEC, PCE, TCE and vinyl chloride. The MCL for TCE was exceeded in groundwater at all nine wells at the Main Plant Area with concentrations ranging from 8.5 ug/l to 53,900 ug/l. The MCL for PCE was exceeded in seven wells with concentrations ranging from 5.9 ug/l to 7110 ug/l.

Monitoring wells on the eastern (CC-02) and western (CC-20 and CC-22) edge of the Main Plant Area contain low levels of VOC contamination. Hydraulically, CC-2 is the most upgradient well at the Main Plant Area, but displays up to 65 ug/l total VOCs, including TCE above the MCL (Figure 10). The four most contaminated wells are within the Main Plant Area in the former UST area and the condensate distillate disposal area. VOC concentrations appear to decrease radially outward from wells CC-03, CC-06, CC-07, and CC-13 as shown in Figure 9. VOC concentrations in CC-13 are an order of magnitude less than the adjacent wells CC-06 and CC-07. CC-13 monitors a deeper interval (124 to 178 ft below ground surface) than adjacent wells CC-06 and CC-07. The vertical extent of contamination decreases with depth and with horizontal distance from the main contaminant source area. The monitoring wells that are in or adjacent to the main contaminant source area (CC-03, CC-06, CC-07 and CC- 13) have two to three orders of magnitude higher concentrations than the monitoring wells that are located outside the Main Plant Area (CC-19 through CC-22) or at a greater distance from the source area (CC-02).

The contaminant plume at the Main Plant Area extends approximately 120 feet from the highly contaminated core defined by wells CC-6 and CC-7 to a projected isopleth of 10 ug/l (Figure 10). Monitor wells at the Main Plant Area are not well situated to characterize the longitudinal boundary of the plume. The contaminant plume is approximately 200 feet wide. The total length of the plume is not known at this time.

#### Semivolatile Organic Compounds

Low levels of SVOCs (less than 3 ug/kg) were detected in the groundwater at the Main Plant Area and at CC-JO. SVOCs detected in three separate wells at the Main Plant Area include 1,2-dichlorobenzene, phenanthrene, and di-n-butyl phthalate. Bis(2-ethylhexyl) phthalate was detected in CC-JO. SVOCs in the groundwater did not exceed MCLs.

#### Inorganics

Twenty-four inorganics (total metals and cyanide) were detected in the groundwater at the Main Plant Area and CC-JO.

Primary MCLs were exceeded at CC-06 for total concentrations of antimony, barium, beryllium, cadmium, chromium, nickel and thallium. Secondary MCLs and action levels were exceeded for aluminum (total), iron (total and dissolved), lead (total) and manganese (total and dissolved) for a number of wells. Table 4 shows which metals exceeded MCLs in the groundwater and the Main Plant Area.

#### DNAPL Investigation

The RI contained an integrated approach to assess the Main Plant Area for the potential distribution of DNAPLs using existing analytical and field observation data. Both groundwater and soil quality data were evaluated to determine the presence of DNAPLs using various screening methods. These techniques included EPA guidance procedures for evaluating groundwater quality data, a method for evaluating analytical data from soils following Feenstra, et. al.(1991), head space screening results from soil samples, and visual observations of groundwater samples using a nonvolatile, hydrophobic dye.

As DNAPLs often accumulate in small pools in the vadose and saturated zones, the likelihood of encountering DNAPLs in a soil sample from a vertical boring or groundwater from a conventional monitor well is remote, unless the boring is drilled directly through the DNAPL pool. Consequently, screening methods that evaluate contaminant concentrations in several different media with several techniques must be employed to determine the potential occurrence of DNAPLs. The database consisted of groundwater and soil analytical data, headspace screening results and a dye survey from the latest round of groundwater sampling.

Results of the screening analysis indicated that DNAPLs may occur in, or upgradient of monitor wells CC-6, CC-7, and CC-13. All three wells are located directly below the former UST area. Soil quality data indicated DNAPLs may occur in the vadose zone at 10-12 feet below grade in MPA-6, and 25-27 feet below grade in MPA-8. Headspace correlation based on a headspace-threshold measurement of 150 ppm. identified potential DNAPLs in borings MPA-2,3,4,6, and 8.

#### B. Former Disposal Area/Mounded Area (FDA/MA)

The source of soil contamination detected at the Former Disposal Area/Mounded Area were buried drums containing still bottoms from Chemclene's solvent recycling process. Approximately 300 drums and adjacent soils were excavated and removed from the area for disposal at an approved facility between 1991 and 1984. Chemclene removed a second cache of drums from the Mounded Area in 1990; however, contaminated soil was left in place.

#### SURFACE SOIL SAMPLES

In April 1996, a total of 21 surface soil samples (including QA/QC samples) were collected from the Former Disposal Area/Mounded Area at depths between 0 and 6 inches below ground surface. Surface soil samples were submitted for VOC and SVOC, metal, and cyanide analyses. Of the surface soil sample locations in the Former Disposal Area/Mounded Area (designated SS- 21 through SS-40), nine locations were within the fenced area, four were within the Mounded Area, and the remaining seven were northwest and southeast of the fenced excavation area (Figure 11).

#### Volatile Organic Compounds

PCE was the most commonly detected Site-related contaminant in the surface soil samples. PCE was detected in ten samples, with a highest concentration of 130 ug/kg in SS-28, and concentrations of less than 10 ug/kg in the remaining nine samples. PCE was the only Site-related VOC detected in excess of the SSL of 40.0 ug/kg (Figure 11). Other organic



contaminants detected at low levels in surface soils were 1,1,1-TCA, 1,2-DCE, and TCE. Distribution of VOCs in surface soils and the VOCs that exceed SSLs are shown in Figure 10.

#### Semivolatile Organic Compounds

Of the surface soil sampling locations at the Former Disposal Area/Mounded Area, bis(2-ethylhexyl)phthalate was detected in all but SS-21 and SS-33, at levels ranging from 55 (SS-35) to 2400 ug/kg (SS-25). Bis(2-ethylhexyl)phthalate was the only SVOC detected in 15 of the 20 samples, and was also detected in field blanks submitted with the surface soil samples. The distribution of SVOCs in the surface soil at the Former Disposal Area/Mounded Area is shown in Figure 12.

The highest total concentration of SVOCs was detected in sample SS-27 (1,747 ug/kg) in the Mounded Area. SVOCs were not detected in excess of the SSLs.

#### Inorganics

The inorganic composition of the Former Disposal Area/Mounded Area surface soils is considered to be generally representative of background conditions, although several metals were detected at levels exceeding SSLs. These metals were: barium, cadmium, chromium, nickel, selenium, and thallium. Barium was detected above the SSL of 32 mg/kg in all 21 of the surface soil samples, at levels ranging from 36.3 (SS-32) to 157 mg/kg (SS-40). Cadmium was detected above the SSL of 6.0 mg/kg in three samples: SS-23 at 8.6 mg/kg; SS-26 at 36.4 mg/kg, and SS-37 at 10 mg/kg. Chromium was detected above the SSL of 19.0 mg/kg in 16 samples, with a maximum concentration of 40.9 mg/kg detected in SS-28. Nickel was detected above the SSL of 21 mg/kg in three samples: SS-26 at 25 mg/kg; SS-28 at 21.9 mg/kg; and SS-31 at 23.5 mg/kg. Selenium was detected above the SSL of 3.0 mg/kg in one sample, SS-40, at 3.9 mg/kg. Thallium was detected above the SSL of 0.4 mg/kg in three samples: SS-25 at 1.6 mg/kg; SS-26 at 3.1 mg/kg; and SS-27 mg/kg. Cyanide was detected in two of the surface soil samples: SS-24, at 0.68 mg/kg; and SS-36, at 21.5 mg/kg. There are no applicable SSLs for cyanide in soils.

#### SUBSURFACE SOIL SAMPLES

The subsurface at the Former Disposal Area/Mounded Area is defined by a total of six soil borings (designated FDA-1 through FDA-6), drilled in March 1996 to depths ranging from 27 to 62 feet below ground surface (Figure 13). The subsurface consists of recent unconsolidated overburden deposits overlying the Cambrian Ledger Dolomite. The Ledger Formation was encountered only in boring FDA-4, at a depth of approximately 60 feet below ground surface. Overburden deposits generally consist of silts and sands interbedded with clays, silty clays, and clayey silts. Subangular limestone/dolomite clasts are found throughout the overburden deposits.

#### Volatile Organic Compounds

Eighteen VOCs were detected in 19 subsurface soil samples at the Former Disposal Area/Mounded Area. Most VOCs were detected in nine or fewer samples. PCE, MEC, and acetone were detected more frequently. PCE was detected in 16 of the 19 subsurface samples although concentrations in nine samples may have resulted from laboratory blank contamination. Concentrations of total VOCs (excluding those detected in laboratory quality control blanks) range from 3 ug/kg (FDA-2 at 25-27 foot) to 505,000 ug/kg (FDA-5 at 8-10 foot). VOCs that may be present from laboratory contamination include 1,2-DCE, MEC, acetone, PCE, and xylenes. Soil samples collected between 2 and 10 ft below ground surface at FDA-3 and FDA-5 and between 3 and 22 ft below ground surface at FDA-4 exhibited total VOC concentrations in excess of 1,000 ug/kg.

The highest concentration, of an individual VOC was PCE at 410,000 ug/kg in FDA-5 at 8-10

feet. This maximum concentration exceeded the SSL (40 ug/kg) for PCE by several orders of magnitude. Maximum detected concentrations for ethylbenzene, MEC, PCE, TCE, and xylenes were also detected in this sample. VOCs that were commonly detected at concentrations above SSLs included PCE, TCE, 1,1,1-TCA, 1,1,2,2-TCA, 1,1-DCA, 1,2-DCE, 1,2-DCA, and xylenes. Borings FDA-4 and FDA-5 are located in or adjacent to the Mounded Area. VOC contamination at the Mounded Area generally decreases with depth. Total VOCs in samples deeper than 20 feet below grade at the Former Disposal Area/Mounded Area are less than 100 ug/kg.

Low levels of VOC contamination were detected at soil borings FDA-1, FDA-2, and FDA-6, however, these contaminants were also detected in laboratory quality control blanks and appear to result from laboratory rather than Site-related contamination.

#### Semivolatile Organic Compounds

SVOCs were detected in 11 of the 19 subsurface soil samples collected from the Former Disposal Area/Mounded Area. These samples were from borings FDA-3, FDA-4, and FDA-5. The most commonly detected SVOCs, including 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, naphthalene, and phenanthrene were detected in 8 to 11 samples. The remaining SVOCs were detected in fewer than 4 samples each. Total SVOC concentrations exceeding 1,000 ug/kg were detected in samples from depths of 2-22 feet at FDA-3, FDA-4, and FDA-5.

#### Inorganics

Thirteen metals were detected in the 19 subsurface soil samples collected at the Former Disposal Area/Mounded Area. The list of metals in the subsurface soils is generally similar to that of the surface soils. SSLs for barium, chromium, and thallium were exceeded for one or more of the subsurface soil samples. Barium was detected above the SSL of 32 mg/kg in FDA-2 at 20-22 feet (33.2 mg/kg); and in FDA-4 at 8-10 feet (60.4 mg/kg). Chromium was detected above the SSL of 19.0 mg/kg in FDA-1 at 25-27 feet (19.9 mg/kg); FDA-2 at 20-22 feet (20.1 mg/kg); FDA-3 at 12-14 feet (22.6 mg/kg); FDA-3 at 8-10 feet (21.3 mg/kg); and FDA-4 at 8-10 feet (20.7 mg/kg). Thallium was detected above the SSL of 0.4 mg/kg in four samples: FDA-1 at 10-12 feet (0.8 mg/kg); FDA-3 at 12-14 feet (0.73 mg/kg); FDA-4 at 20-22 feet (1.3 mg/kg); and FDA-4 at 3-5 feet (2.2 mg/kg). However, all thallium levels, except that of FDA-3 were detected at similar levels in the field quality control blanks.

#### GROUNDWATER

This subsection describes the known horizontal and vertical extent of contamination detected in groundwater underlying the Former Disposal Area/Mounded Area. Groundwater contamination in this area is defined by analytical results for groundwater samples collected from a total of nine monitoring wells. Concentrations of detected compounds are compared with the corresponding MCLs.

Groundwater samples were collected from existing Former Disposal Area/Mounded Area monitor wells (CC-5, -9, -10, -11, and -14) and newly installed wells (CC-15 through CC-18) in April and May 1996. Unfiltered groundwater samples were analyzed for VOCs, SVOCs, total metals, and cyanide, and for alkalinity, chloride, low concentration metals, nitrate, nitrite, silica, sulfate, total dissolved solids (TDS), and total organic carbon. Filtered groundwater samples were analyzed for dissolved metals. Conventional water quality parameters (alkalinity, nitrate, silica, sulfate, TDS) were used to characterize background groundwater chemistry.

#### Volatile Organic Compounds

Twenty VOCs were detected in the groundwater at the Former Disposal Area/Mounded Area. Total VOC concentrations ranged from a low of 8.1 ug/l in CC-11 to a high of 3,298 ug/l in CC-5. Figure 14

presents the distribution of VOCs in the monitoring wells at the Former Disposal Area/Mounded Area. VOCs that exceeded groundwater MCLs are underlined.

The following VOCs were detected at levels exceeding the MCLs: 1,1-DCE at wells CC-5, CC-15, and CC-16; 1,2-DCA at wells CC-5 and CC-16; cis-1,2-DCE at wells CC-5, CC-16, and CC-17; PCE at wells CC-5, CC-9, CC-15, CC-16; and TCE at wells CC-5, CC-9, CC-14, CC-15, CC-17, and CC-18.

An isopleth map presenting total VOC concentrations was created with analytical data from the May 1996 monitor well sampling event and June 1996 domestic well sampling event. The domestic well data are discussed in the next section. The monitoring wells exhibiting the highest concentration of VOCs (CC-5, CC-15, CC-16, and CC-17) are configured in a line extending along the south and southwest portion of the Former Disposal Area/Mounded Area. VOC contamination in CC-5 is 1 to 2 orders of magnitude higher than the surrounding wells CC-9, CC-10, CC-15, CC-16, CC-17, and CC-18, all of which are within a distance of 50 to 250 feet from CC-5. The VOC contaminant plume, centered at CC-5, extends from the Former Disposal Area/Mounded Area to the residences along Hillbrook Circle as shown in Figure 15. Due to the relatively flat potentiometric surface in the area encompassing the Former Disposal Area/Mounded Area, contamination appears to spread laterally upgradient as well as migrating downgradient. In this mode of migration, contamination has moved toward CC-14, before migrating downgradient. The plume is elliptical and appears discontinuous in Hillbrook Circle. Total VOC concentrations within the Hillbrook Circle Development are up to 180 ug/l at a distance of 2,100 feet from the Former Disposal Area/Mounded Area.

#### Semivolatile Organic Compounds

SVOCs were not detected in concentrations above the detection limit in groundwater from the Former Disposal Area/Mounded Area monitor wells.

#### Inorganics

Total metals that were detected in Former Disposal Area/Mounded Area wells in concentrations in excess of the corresponding MCLs were aluminum at CC-10 and CC-14, beryllium at CC-14, cadmium at CC-11; iron at CC-5, -10, -11, and -14; and manganese at CC-10, -11, and -14. Elevated metal concentrations at CC-11 are the result of low pH (6.42) at this well and represent local background conditions, rather than Site-related contamination.

Of the dissolved metals, iron and manganese levels, both in CC-11, exceeded associated MCLs. Cyanide was not detected in the Former Disposal Area/Mounded Area groundwater samples.

#### C. Domestic Wells

Groundwater samples were collected from domestic wells in the vicinity of Chemclene during sampling events conducted in June, August, and December of 1995, and of June 1996. Samples were analyzed for VOCs and SVOCs. This subsection presents analytical results from the June 1996 sampling event and compares total VOC concentrations of unfiltered samples with results of corresponding unfiltered samples from the August 1995 sampling event. Only 15 unfiltered samples (including a duplicate) were collected in August 1995. Only unfiltered data are presented because filtered samples represent the filter efficiency; and in general, only trace or nondetectable levels of VOCs have been detected in domestic wells that have filter systems.

Samples were collected from a total of 49 domestic wells in June 1996. Both unfiltered and filtered samples were collected from 18 of the 49 domestic wells, for a total of 67 samples.

#### Volatile Organic Compounds

VOCs were detected at concentrations above the detection limits in samples from 20 of the 49 domestic wells during the June 1996. VOCs were detected in both filtered and unfiltered samples from five of the domestic wells. Total VOC concentrations were greater than or equal to 10 ug/l in eight of the 49 domestic wells: DW-6B, 9B, 16B, 36A, 36B, 41B, 57B, and 58B. A maximum total VOC concentration of 289 ug/l was detected in the sample from DW-41B.

Three organic contaminants (1,1-DCE, PCE, and TCE) were detected at levels exceeding corresponding MCLs. A concentration of 18 ug/l of 1-1 DCE was detected in DW-41B, exceeding the MCL of 7.0 ug/l. PCE was detected at or above the MCL of 5.0 ug/l in DW-41B (38 ug/l), DW-58B (14 ug/l), and DW-65B (5.0 ug/l). TCE was detected in excess of the MCL of 5.0 ug/l in the following wells: DW-36B (36 ug/l); DW-41 (140 ug/l); DW-6B (34 ug/l); DW-9B (7.0 ug/l); DW-57B (23 ug/l); DW-58B (110 ug/l); and DW-67B (7.0 ug/l).

As shown in Figure 14, the distribution of VOCs detected in groundwater at the Site is defined by a major plume extending to the southeast from the Former Disposal Area/Mounded Area, and a second area of groundwater contamination to the southeast. These areas of contamination do not form a continuous plume, but are separated by several wells in which VOCs have not been detected. This distribution pattern may be a result of differences in domestic well depth and construction.

Based on June 1996 analytical data, selected wells were compared to results from August 1995, total VOC concentrations had increased in 5 samples, decreased in 8 samples, and remained the same (nondetect) in 2 samples. The highest total VOC concentration in August 1995 was 121 ug/l in well DW-36B, compared with 55 ug/l in the same well in June 1996. Well DW-36B exhibited the greatest change in VOC concentrations between the 2 sampling intervals, with the other wells showing differences of only a few ug/l from August 1995 to June 1996. Table 5 presents the total VOC concentration of selected domestic wells for August 1995 and June 1996.

#### Semivolatile Organic Compounds

SVOCs were detected at concentrations above the detection limit in samples from four of the 49 domestic wells. Bis(2-ethylhexyl)phthalate was detected in DW-36B (8 ug/l); in DW-52B (16 ug/l); and in DW-55B (23 ug/l). Di-n-butyl-phthate was detected in DW-61 at concentrations of 39 and 22 ug/l (duplicate sample).

#### D. Potential Disposal Area

The Potential Disposal Area was identified during an examination of aerial photographs from the 1950's and 1960's. This area exhibited signs of excavation activities, stressed vegetation, and discarded debris. The Potential Disposal Area lies in a wooded area approximately 200 feet west of the Main Plant Area. Based on the aerial photographs, the Potential Disposal Area is approximately 100 feet by 100 feet in size. The Potential Disposal Area lies between a residential development to the north and the gas pipeline right-of-way to the south. A small stream, which flows from the residential properties, bounds the Potential Disposal Area to the west. Small mounds of soil and concrete blocks were scattered throughout the area. Debris in the Potential Disposal Area included auto parts, an empty crushed drum, a barbed wire fence along the northern boundary, and miscellaneous trash. To determine the extent of the Potential Disposal Area, a geophysical grid for a magnetic survey was configured so that the boundaries of the grid extended past the obvious boundaries of the Potential Disposal Area. The geophysical grid in the Potential Disposal Area encompassed an area 160 feet wide (east-west) by 120 feet long (north-south). (See Figure 16)

A geophysical survey, soil gas survey, and subsurface boring program were conducted in the

winter of 1995 through spring of 1996 to determine the nature and extent of contamination at the Potential Disposal Area.

The application of a magnetometer/gradiometer survey at the Potential Disposal Area indicates that a small amount of metal is strewn about the ground surface. Magnetic field and gradient anomalies were generally small in area and less than 100 gammas. Anomalies associated with a number of buried drums are usually greater than 200 gammas in strength. Nearly all significant magnetic field and gradient anomalies above 50 gammas and 5 gammas per foot respectively, were associated with some form of metal lying at the ground surface. These results suggest that drums were probably not buried at the Potential Disposal Area. Results of the magnetometer/gradiometer survey were consistent with results of the soil gas survey and soil boring program at the Potential Disposal Area.

#### Soil Gas Survey

Fourteen soil gas samples were collected in March 1996 at the Potential Disposal Area. Soil-gas collectors were placed in areas identified as suspect following the geophysical survey and several Site walk-overs. Additional devices were installed to provide adequate areal coverage. Soil gas samples were analyzed for eight TCE-related VOCs listed in Table 6. VOCs were not detected in the soil gas samples collected at the Potential Disposal Area.

#### Subsurface Soil

The subsurface at the Potential Disposal Area is defined by six soil borings (Figure 16). Soil borings were drilled to a maximum depth of 27 feet below ground surface. Bedrock was not encountered at the Potential Disposal Area in any of the soil borings. Overburden deposits at the Potential Disposal Area consist of reddish brown and whitish-gray silts and sands interbedded with clays, and clayey silts and sands. Gravel and pebble size limestone/dolomite clasts are found throughout the overburden deposits but occur in greater density in the 2 to 6 foot interval. Silt units beneath the Potential Disposal Area range in thickness from 1 foot (PDA-3) to 19 feet (PDA-5). Sand units range in thickness from 2 feet (PDA-4) to 25 feet (PDA-3) at the Potential Disposal Area.

Sixteen subsurface soil samples were collected for laboratory analysis from the 5 borings at the Potential Disposal Area. Samples were collected from three 2-foot intervals in each boring. Since organic vapors were not detected in the borings, the intervals sampled for laboratory analysis were chosen based on lithologic changes to achieve horizontal and vertical coverage, and to determine vertical extent of contamination, if any exists.

#### Volatile Organic Compounds

A low level of toluene was detected in one sample at the PDA-2 at 25-27 foot depth. VOCs detected but at concentrations not substantially above levels detected in laboratory blanks) include acetone, MEC, and total xylene. MEC was detected in all sixteen soil samples collected at the Potential Disposal Area ranging in concentrations from 7 to 21 ug/kg (all B flagged). SSLs were exceeded for NEC (10 ug/kg) in 15 subsurface soil samples, all of which were B flagged and associated with possible blank contamination.

#### Semivolatile Organic Compounds

A low concentration of diethyl phthalate was detected in one sample at the PDA-5, 25-27 feet. (42 ug/l). Other SVOCs detected in the samples but flagged with a B qualifier (concentrations not substantially above levels detected in laboratory blanks) included bis (2-ethylhexyl)phthalate (Figures 4-26 and 4-27). SSLs were not exceeded for SVOCs in the

subsurface at the Potential Disposal Area.

#### Inorganics

Twenty metals and cyanide were detected in the subsurface at the Potential Disposal Area. Seventeen metals were detected in 10 or more of the samples collected in the subsurface at the Potential Disposal Area.

SSLs were exceeded for arsenic, barium, chromium, and selenium in the subsurface at the Potential Disposal Area. SSLs were exceeded for arsenic and barium in two samples with maximum concentrations of 16.2 mg/kg (PDA-1 at 6-8 feet) and 53.2 mg/kg (PDA-5 at 8-10 feet), respectively. SSLs were exceeded for chromium and selenium in one sample at concentrations of 22.1 mg/kg and 23.6 mg/kg (PDA-4 at 25-27 ft.) respectively. These metals were present at elevated levels in the background soil sample (FDA-2), and may therefore represent ambient soil conditions. With the exception of selenium, concentrations of all the metals lie within average range for background locations in the eastern United States.

#### E. Previous Investigation Data

##### Soil

Several soil gas surveys, soil sampling programs, and groundwater sampling events have been conducted at the Site. Two soil gas surveys were performed at the Site between 1989 and 1993. Soil gas surveys were performed at the Main Plant Area and Former Disposal Area/Mounded Area in December 1989, and a second soil gas survey was conducted in the mounded area of the Former Disposal Area/Mounded Area in October 1992.

Total VOC soil gas concentrations ranged from undetected to 530 ppm in the Former Disposal Area/Mounded Area. VOC concentrations were slightly lower farther from the Mounded Area, but most samples still showed discernible levels of contamination. Total VOC soil gas concentrations at the Main Plant Area ranged from 1.73 ppm to 1,035 ppm. The area southeast of the distillation building had the highest readings.

The soil gas surveys indicated the presence of VOC contamination of the soil. This data was not used quantitatively in the risk assessment due to the nature of the data, but was used to indicate areas of potential concern for inhalation exposure.

Several soil sampling programs have been conducted at the Main Plant Area and Former Disposal Area/Mounded Area since 1990. Soil borings were installed at the main plant to investigate contamination in soils below the former USTs, at the condensate disposal area (area southeast of the distillation building), and at the garage loading dock. Borings have also been installed around the excavations at the Former Disposal Area/Mounded Area created by the removal of drums and debris, and the Mounded Area. Surface soil samples have been collected from the Main Plant Area and the Former Disposal Area/Mounded Area.

Soil borings installed in the excavation area of the Former Disposal Area/Mounded Area in 1990 indicated the presence of VOCs (6 - 96 ug/kg total VOC). Soil borings installed in the Mounded Area in 1992 showed much higher levels of VOCs (up to 224,400 ug/kg total VOC). Constituents detected included 1,1,1-TCA, PCE, TCE, 1,1,2-TCA, 1,1-DCE, 1,2-DCA, and bromoform. Similar compounds and concentrations were detected in the soil borings sampled in 1996 from the Mounded Area. Additionally, low levels of PAHs were detected in the samples collected in 1996. Soil borings were not sampled from the Former Disposal Area excavation area in 1996. Surface soil samples were collected at the mounded area of the Former Disposal Area/Mounded Area in February 1991 and March 1996. VOCs were detected during both sampling events, and the concentrations in

1996 were lower than the 1991 concentrations.

Soil boring samples collected from the Main Plant Area in January 1990 and March 1996 indicated that the highest contamination was present in the area from which the USTs were removed. Surface soil samples were collected from the Main Plant Area in March 1996. VOCs were detected in many of the samples.

## VII. SUMMARY OF SITE RISKS

Following the Remedial Investigation, analyses were conducted to estimate the human health and environmental hazards that could result if contamination at the Site is not cleaned up. These analyses are commonly referred to as risk assessments and identify existing and future risks that could occur if conditions at the Site do not change. The Baseline Human Health Risk Assessment (BLRA) evaluated human health risks and the Ecological Risk Assessment (ERA) evaluated environmental impacts from the Site.

### A. Human Health Risks

The BLRA assesses the toxicity, or degree of hazard, posed by contaminants related to the Site, and involves describing the routes by which humans could come into contact with these substances. Separate calculations are made for those substances that are carcinogenic (cancer causing) and for those that are non-carcinogenic, but can cause other adverse health effects.

The primary objective of the risk assessment conducted was to assess the health risks to individuals who may have current and future exposure to contamination present at and migrating from the Site under existing site conditions. The risk assessment is comprised of the following components:

- ò Identification of Chemicals of Potential Concern (COPCs) - identify and characterize the distribution of COPCs found on-Site.
- ò Exposure Assessment - identify potential pathways of human exposure, and estimate the magnitude, frequency, and duration of these exposures.
- ò Toxicity Assessment - assess the potential adverse effects of the COPCs.
- ò Risk Characterization - characterize the potential health risks associated with exposure to site related contamination.

Each of these steps is explained further below.

#### 1. Identification of COPCs

The identification of COPC includes data collection, data evaluation, and data screening steps. The data collection and evaluation steps involve gathering and reviewing the available site data and developing a set of data that is of acceptable quality for risk assessment. This data set is then further screened to reduce the data set to those chemicals and media of potential concern. The data used for the quantitative risk analysis were all validated prior to use in the risk assessment.

#### Soil

The only soil data that have been validated are the data collected during the RI conducted by EPA. Therefore, the 1996 soil sampling data were used for the quantitative risk assessment. Soil boring data collected from between 0-12 feet were used to evaluate subsurface exposure. Surface soil samples collected from 0-0.5 feet were used to evaluate surface soil exposure. Soil samples

were analyzed for VOCs, SVOCs, metals, and cyanide.

The 1996 soil data were grouped into the six exposure areas previously discussed for the risk assessment. The areas include the soils at the Former Disposal Area/Mounded Area, the UST area, the aboveground storage tank area, the area southeast of the distillation building, and the area south of the garage at the main plant.

#### Groundwater

Groundwater data from August 1994 and May 1996 were used for the risk analyses. These were the only data collected at the Site that have been validated. In general, VOC concentrations appear to have remained the same or have slightly decreased over time. Therefore, use of the 1994 and 1996 groundwater data are representative of current Site conditions.

The three most contaminated wells within each plume were selected for the quantitative risk assessment. Wells CC-6, CC-7, and CC-13 were used to represent worst-case groundwater at the Main Plant Area, and wells CC-5, CC-15, and CC-16 were used to represent worst-case groundwater at the Former Disposal Area/Mounded Area.

Risks associated with use of the domestic wells were also evaluated. Data from wells without carbon filters were used to evaluate current residential risks and data collected prior to the filter (or after the filter if breakthrough was detected) for the wells equipped with carbon filters were used to evaluate potential future residential risks.

#### Background Samples

Five background surface soil samples and four background soil borings have been collected at the Site. Only two samples from the background soil borings are useable for the risk assessment due to the depth of the samples used to represent subsurface soil exposure.

Data from the Philadelphia Suburban Water Company (PSWC) Great Valley well was representative of background conditions in the aquifer beneath the Site. The inorganic data collected from the Great Valley well in October 1992, prior to the well becoming contaminated, was used as the background groundwater for the risk assessment.

#### Selection of Chemicals of Potential Concern

The COPC selection process was conservative, to ensure selection of the most constituents. Selection of COPCs was based on the criteria presented in EPA Region III guidelines. The maximum concentration of each detected constituent in each media was compared to the following criteria to select the COPCs per area. If the maximum concentration of a constituent exceeded each of the criteria, the constituent was selected as a COPC.

- ò Comparison with Health-based Criteria: The maximum detected chemical concentrations in groundwater and soil were compared with risk-based concentrations (RBCs) that were developed using current toxicity factors in the exposure formulas provided by EPA Region III. These screening level RBCs were based on a target hazard index of 0.1 and a target cancer risk of  $1 \times 10^{-6}$ . For soils, the cross-media protection criteria (for air) were developed using the EPA Soil Screening Guidance. Soil saturation concentrations were calculated and used as the screening value if they were less than the soil RBC. Constituents with maximum detected concentrations below the RBC or soil saturation values were eliminated from the COPC list.



- ò Comparison with Background Samples: The 95 percent upper tolerance limit (95% UTL) was calculated for each inorganic constituent detected in the set of background soil samples. For potential source areas where the maximum detected concentration was greater than the background 95% UTL (or the maximum background concentration if the 95% UTL is greater than the maximum), the inorganic constituent was retained as a COPC.
- ò Comparison with Recommended Dietary Allowances (RDAs): Chemicals which are human nutrients, present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and toxic only at very high doses were eliminated from the quantitative risk analysis. These constituents are calcium, magnesium, potassium, and sodium. All of the human nutrients detected in groundwater and soil, except for manganese in the Main Plant Area plume, result in intakes below RDAs. Ingestion of groundwater from the Main Plant Area plume by future adult residents would result in an intake of 300 mg/day, which slightly exceeds the RDA of 280 mg/day. This is not a significant exceedence, and manganese is not a significant contributor to the intake and resulting potential health effects.

Iron, which is also considered a human nutrient, was evaluated quantitatively in the risk assessment because there is a provisional toxicity value for iron. Ingestion of soil at the Former Disposal Area excavated area would result in an intake of 11.5 mg/day by a child which slightly exceeds the RDA for a child of 10 mg/day. Ingestion of groundwater from the Main Plant Area plume would result in an adult intake of 640 mg/day for an adult resident and an intake of 320 mg/day for a child resident, which both exceed the RDA of 15 mg/day and 10 mg/day for an adult and child, respectively.

#### Clemicals of Potential Concern

Table 7 identifies the chemicals that were selected as COPC based on the above screening methodology for each of the six potential source areas (soil) and the two groundwater plumes. There were no COPC present at the area south of the garage, therefore this area was not considered a potential source area and a quantitative risk evaluation was not carried out.

The domestic wells located off the Chemcene property were also screened using the above screening and data evaluation methods. The data were separated into two separate sets, domestic wells with filters and domestic wells without filters. All of the domestic wells that were sampled in 1995 and had at least one VOC detected were screened for COPC.

Although the ROD focuses on the chemical risk-drivers at the Site, other contaminants not specifically discussed in the ROD were also observed in environmental samples at noteworthy concentrations and are a concern to EPA. (A detailed evaluation of all chemicals exceeding risk screening criteria, i.e. - CoPCs, is presented in the Baseline Risk Assessment of the Remedial Investigation Report.)

## 2. Exposure Assessment

An exposure assessment involves three basic steps: 1) identifying the potentially exposed populations, both current and future; 2) determining the pathways by which these populations could be exposed; and 3) quantifying the exposure. Under current Site conditions, the BLRA identified potential populations as having the potential for exposure to Site-related contaminants, either currently and/or in the future. The migration pathways for the contamination from the source areas include: volatilization of the chlorinated solvents from soil, subsurface soil and groundwater, downward migration of the VOCs from soil to the

groundwater, and lateral downgradient transport of VOCs in the groundwater.

#### Current Land Use

Chemclene currently sells hydraulic oil, industrial cleaning solvents, hydraulic fluid, and hydrogen peroxide, and operates a hauling operation from the Main Plant Area of the Site. Therefore, current populations which could be exposed include the employees and visitors of Chemclene Corporation. Chemclene uses a local on-Site well for process and wash water at the plant. This water is not used as a potable water supply. Chemclene uses water from domestic well DW-010 or bottled water as a potable water supply for site workers. The Main Plant Area and part of the Former Disposal Area/Mounded Area are not physically separated from the surrounding land and are accessible to the off-Site public under current conditions. Therefore, potentially exposed populations to the Main Plant and unfenced portions (mounded area) of the Former Disposal Area/Mounded Area include trespassers. Individuals currently using the Chemclene property may be exposed to contaminants in the surface soil.

Another population which currently could be exposed to Site contaminants is the residents that live hydraulically downgradient of the Chemclene property. Residents near the Chemclene property obtain their potable water from private groundwater wells. Twenty of the 51 residential wells in the vicinity of the plant have carbon filters to treat organic contamination. Data obtained from domestic well sampling indicate elevated levels of several organic constituents in groundwater that are Site-related. These persons may be exposed to constituents in groundwater during potable use.

In summary, the populations potentially exposed and the possible pathways under current land use include:

1. Chemclene employees working outdoors potentially exposed through incidental ingestion, dermal contact, and inhalation of volatiles and fugitive dust from surface soils.
2. Trespassers playing on or walking across the Chemclene property potentially exposed through incidental ingestion, dermal contact, and inhalation of volatiles and fugitive dust from surface soils.
3. Residential groundwater users downgradient of Chemclene property potentially exposed through ingestion of and dermal contact with groundwater, and inhalation of volatiles from groundwater while showering or bathing.

#### Potential Future Uses

The predominant land use in East Whiteland Township is agriculture, rural residential, and open space. However, agriculture and open space areas are decreasing as the area is being converted to residential and commercial properties. The future land use for the Site and surrounding area is expected to be similar to the current land use, either commercial or residential. The Chemclene property is currently commercial, but could possibly be converted to a residential area in the future. This property could also be used by a different owner for commercial operations. This may entail expanding the number of workers, and may include using the groundwater as a potable water supply. Also, construction activities may take place at the Site.

In summary, the populations potentially exposed and the possible exposure pathways under future land use include:

1. Construction workers potentially exposed through incidental ingestion, dermal contact, and inhalation of volatiles and fugitive dust from surface and

subsurface soils.

2. Trespassers playing on or walking across the Chemclene property potentially exposed through incidental ingestion, dermal contact, and inhalation of volatiles and fugitive dust from surface soils.
3. Residents living on the Chemclene property potentially exposed through incidental ingestion, dermal contact, and inhalation of volatiles and fugitive dust from surface soils, and ingestion of and dermal contact with groundwater, and inhalation of volatiles from groundwater while showering and bathing.
4. Residential groundwater users living downgradient of the Chemclene property potentially exposed through ingestion of and dermal contact with groundwater, and inhalation of volatiles from groundwater while showering and bathing.
5. Commercial and construction workers potentially exposed through ingestion of groundwater from beneath the Chemclene property.

In order to quantify the potential exposure associated with each pathway, assumptions must be made for various factors used in the calculations. Table 8 summarizes the values used in this BLRA.

### 3. Toxicity Assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals. Where possible, the assessment provides a quantitative estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects.

A toxicity assessment for contaminants found at a Superfund site is generally accomplished in two steps: 1) hazard identification; and 2) dose-response assessment. Hazard identification is the process of determining whether exposure to an agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer or birth defects) and whether the adverse health effect is likely to occur in humans. It involves characterizing the nature and strength of the evidence of causation.

Dose-response evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the administered population. From this quantitative dose-response relationship, toxicity values (e.g., reference doses and slope factors) are derived that can be used to estimate the incidence or potential for adverse effects as a function of human exposure to the agent. These toxicity values are used in the risk characterization step to estimate the likelihood of adverse effects occurring in humans at different exposure levels.

For the purpose of the risk assessment, contaminants were classified into two groups: potential carcinogens and noncarcinogens. The risks posed by these two types of compounds are assessed differently because noncarcinogens generally exhibit a threshold dose below which no adverse effects occur, while no such threshold can be proven to exist for carcinogens. As used here, the term carcinogen means any chemical for which there is sufficient evidence that exposure may result in continuing uncontrolled cell division (cancer) in humans and/or animals. Conversely, the term noncarcinogen means any chemical for which the carcinogenic evidence is negative or insufficient.

Slope factors have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminants of concern. Slope factors, which are expressed in units of (mg/kg/day)<sup>-1</sup> are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of

the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied to account for the use of animal data to predict effects on humans. Slope factors used in the baseline risk assessment are presented in Table 10.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of acceptable lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g. the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. Reference doses used in the baseline risk assessment are presented in Table 9.

#### 4. Human Health Effects

Toxicological profiles of selected constituents, including carbon tetrachloride, 1,1-DCE, cis-1,2-DCE, PCE, 1,1,2-TCA, and TCE which are primary contaminants contributing to Site risks, can be found in Appendix A. In addition, a toxicity profile is provided for lead which does not have published toxicity values.

#### 5. Risk Characterization

The risk characterization process integrates the toxicity and exposure assessments into a quantitative expression of risk. For carcinogens, the exposure point concentrations and exposure factors discussed earlier are mathematically combined to generate a chronic daily intake value that is averaged over a lifetime (i.e., 70 years). This intake value is then multiplied by the toxicity value for the contaminant (i.e., the slope factor) to generate the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the contaminant. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) established acceptable levels of carcinogenic risk for Superfund sites ranging from one excess cancer case per 10,000 people exposed to one excess cancer case per one million people exposed. This translates to a risk range of between one in 10,000 and one in one million additional cancer cases. Expressed as scientific notation, this risk range is between  $1.0\text{E-}04$  and  $1.0\text{E-}06$ . Remedial action is warranted at a site when the calculated cancer risk level exceeds  $1.0\text{E-}04$ . However, since EPA's clean up goal is generally to reduce the risk to  $1.0\text{E-}06$  or less, EPA also may take action where the risk is within the range between  $1.0\text{E-}04$  and  $1.0\text{E-}06$ .

The potential for noncarcinogenic effects, is evaluated by comparing an exposure level over a specified time period (i.e., the chronic daily intake) with the toxicity of the contaminant for a similar time period (i.e., the reference dose). The ratio of exposure to toxicity is called a hazard quotient. A Hazard Index (HI) is generated by adding the appropriate hazard quotients for contaminants to which a given population may reasonably be exposed. The NCP also states that sites should not pose a health threat due to a non-carcinogenic, but otherwise hazardous, chemical. If the HI exceeds one (1.0), there may be concern for the potential non-carcinogenic health effects associated with exposure to the chemicals. The HI identifies the potential for the most sensitive individuals to be adversely affected by the noncarcinogenic effects of chemicals. As a rule, the greater the value of the HI above 1.0, the greater the level of concern.

Table 9 summarizes the total risk levels for current and future Residential Well Users. Table 10

summarizes the total risk levels from all appropriate exposure routes calculated for each group of individuals. Table 11 summarizes the total risk levels by each area (i.e. Former Disposal Area, Main Plant Area).

## B. Ecological Risk Assessment

The ecological risk assessment was designed to evaluate the potential threats to ecological organisms from exposure to Site contaminants and to establish potential Site-specific clean-up level(s) for the contaminants of concern. Both acute (short-term) and chronic (long-term) studies were conducted for a variety of organisms, representing several different trophic levels. Direct toxicity usually results from direct exposure to certain metals and volatile compounds, and is best evaluated from laboratory or on-Site bioassays. Both chronic and acute bioassays were used to assess direct toxicity at this Site. Indirect or secondary toxicity usually results when birds and mammals accumulate contaminants (some metals, PCBs, and pesticides) in their bodies from eating contaminated prey. Therefore, chronic threats (long-term survival, growth and reproduction) to birds and; mammals were assessed by conservatively estimating the amount of contaminated prey that may be consumed on-Site and comparing that dose to a known effect level. The following summarizes the various tools that were used to assess ecological risk at the Site:

- o surface water bioassays with invertebrates and fish
- o sediment bioassays with amphipods and midges
- o soil bioassays with, earthworms
- o food chain modeling with birds and mammals.

The results indicate the following:

- o Three potential wetland areas were identified between the Main Plant Area and the Former Disposal Area/Mounded Area.
- o With the exception of one sampling location (W1), the results of a 7-day aqueous phase toxicity evaluation using the cladoceran *Ceriodaphnia dubia* suggest that there is no toxicity associated with surface water to freshwater invertebrates at the Site.
- o The results of a 7-day aqueous-phase toxicity evaluation using the fish *Pimephales promelas* suggest that there is no toxicity associated with surface water to freshwater invertebrates at the Site.
- o The results of a 10-day solid-phase toxicity evaluation using the crustacean (*Hyallela azteca*) and midge (*Chironomus tentans*) suggest that there is no acute or chronic toxicity associated with surface sediment to freshwater invertebrates at the Site.
- o The results of the 14-day and 28-day solid-phase toxicity evaluation using *Eisenia foetida* suggest that there is no toxicity (acute or chronic) associated with the surface soil to soil-dwelling invertebrates at the Site.
- o The results of the hazard quotient calculations for omnivorous and carnivorous mammals suggest that the levels of PCBs, aluminum, chromium, lead, manganese, and selenium in the surface soil, surface water, and soil invertebrate community at the Site are sufficient to pose a risk to the survival, growth, and/or reproduction of omnivorous and carnivorous mammals, all long-term effects anticipated if these organisms feed constantly onsite.

ø The results of the risk characterization for omnivorous and carnivorous birds suggest that there is also a potential chronic risk associated with PCBs, aluminum, cadmium, lead, and zinc at the Site.

These results suggest that the levels of PCBs, aluminum, cadmium, lead, and zinc in the surface soil, surface water, and soil invertebrate community at the Site are sufficient to pose a risk to the survival, growth, and/or reproduction of omnivorous and carnivorous birds.

#### RECOMMENDATIONS

The weight of evidence approach was used to evaluate the results of the ecological risk assessment. Compounds were evaluated based on the mechanism of toxicity and the measurement endpoint which supported the evaluation related to the mechanism. Two approaches were evaluated, direct toxicity which include metals and volatiles, and food chain accumulation which include PCB, pesticides, and some metals.

The direct toxicity evaluations indicate that metals or volatiles do not pose a risk through direct toxicity.

PCBs were detected in surface soils at several locations within the Former Disposal Area/Mounded Area. Based on food chain evaluations, the levels observed in those areas pose a potential chronic ecological risk. Although metals pose a potential ecological risk, these are not Site-related and are representative of background conditions. However, the selected alternative will eliminate any potential ecological risk associated with exposure to soils contaminated with PCBs.

#### VIII. DESCRIPTION OF REMEDIAL ALTERNATIVES CONSIDERED FOR THE SITE

The Feasibility Study (FS) discusses a series of alternatives to address the subsurface soil and groundwater at the Main Plant Area and Former Disposal Area and groundwater contamination south of the Chemclene property. The FS and Addendum (May 29, 1997) also provide supporting information relating to the alternatives in this ROD.

Four to eight alternatives; for each of the media at the two locations were identified as possible response actions. These are numbered to correspond with alternatives found in the FS. The alternatives will be discussed in the following sections: water supply alternatives for both areas, Main Plant Area soil and groundwater alternatives, and Former Disposal Area soil and groundwater alternatives. For a summary of alternatives, see Table 12.

##### WATER SUPPLY

Alternative WS-G-3a:	Public Water Supply
Alternative WS-G-3b:	Well Head Treatment

Alternative WS-G-3-a:	Public Water Supply
Capital Cost:	\$ 408,600
Operation and Maintenance:	\$ 97,371
Total:	\$ 505,971

The objective of this alternative is to prevent contact with contaminated groundwater at the residences affected or potentially affected by the Site. This objective can be accomplished by connecting residences affected and potentially affected by the Site to a public drinking water supply. Establishment of a permanent connection to a public water supply would eliminate the use of contaminated groundwater. Affected residential wells would be abandoned upon connection

to a public water supply or converted to monitoring wells. By the end of 1997, Philadelphia Suburban Water Company plans to install water mains in Phoenixville Pike from Aston Road to Conestoga Road, and to extend the existing main in Conestoga Road north to Bacton Hill Road.

Because contaminated media would be left on the Site, a review of the Site conditions would be required every five years, as specified in the NCP.

Alternative WS-G-3b:	Well Head Treatment
Capital Cost:	\$ 113,676
Annual Operation and Maintenance:	\$ 42,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 979,647

The objective of well head treatment would be to reduce the concentrations of VOC contaminants in residential drinking water to meet drinking water standards. Well head treatment would include the purchase, installation, maintenance, and monitoring of carbon filters at each of the affected residences.

Residences hydraulically downgradient of the Former Disposal Area/Mounded Area include homes in the Hillbrook Circle development and nearly all residences along Conestoga Road and Phoenixville Pike. Only one residence is hydraulically downgradient of the Main Plant Area(DW-10). Presently, 19 residences in Hillbrook Circle and on Phoenixville Pike are equipped with either single or double canister unit filters.

Under this alternative, contaminated media would be left on the Site and a review of the Site conditions would be required every 5 years.

#### MAIN PLANT AREA

##### Soil Alternatives

MPA S-1:	No Action
MPA S-2:	Institutional Controls
MPA S-3:	Capping
MPA S-4:	InSitu Soil Vapor Extraction

Alternative MPA-S-1:	No Action
Capital Cost:	\$0
Annual Operation and Maintenance:	\$0
Total Cost:	\$0

The NCP requires that EPA consider a "No Action" alternative for every Superfund site to establish a baseline or reference point against which each of the remedial action alternatives are compared. In the event that the other identified alternatives do not offer substantial benefits over this alternative, the No Action alternative may be considered a feasible approach.

Alternative MPA-S-2:	Institutional Controls
Capital Cost:	\$ 89,000
Annual Operation and Maintenance:	\$ 56,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 1,145,000

The purpose of the institutional controls is to prohibit temporarily or permanently certain activities on parts of the Site that pose unacceptable risk. Institutional controls protect

human health to some degree by diminishing the potential for exposure. Institutional controls would include deed restrictions to limit future use of the Site, fencing to restrict access, and Site reviews every five years.

Alternative MPA-S-3:	Capping
Capital Cost:	\$ 343,000
Operation and Maintenance:	\$ 30,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 940,441

This alternative consists of installation of a cap over the Main Plant Area soils which have concentrations of contaminants which are above the clean up standards established for the protection of groundwater. For purposes of the cost evaluation, the cap is assumed to be concrete and to extend around the existing buildings. This would reduce infiltration through contaminated soil and allow the facility to remain available for commercial use. This is practicable because the building floors provide a cap. In the event of disuse of the existing buildings, further evaluations of the soils beneath the buildings would be required to determine the need for extension of the cap. In addition, any existing equipment or tanks shall be removed in order to allow for the extension of the cap over affected areas. The actual size and locations of the capped areas would be determined during the remedial design phase of the project. Key elements of this alternative include Site grading, installation of a cap in the Main Plant Area, including stormwater controls, vapor monitoring points, and long-term monitoring.

Alternative MPA-S-4:	In-Situ Soil Vapor Extraction (SVE)
Capital Cost:	\$ 827,000
Annual Operation and Maintenance:	\$ 352,000
Operation and Maintenance Period:	5 Years
Total Cost:	\$ 2,351,000

The purpose of In-Situ SVE is to reduce the mass and concentration of VOC contaminants in the soil which are acting as a source of contamination to groundwater. The VOC contaminants would be removed from the Main Plant Area soils. Key elements of this alternative include installation of extraction wells (the depth and number of wells to be determined during remedial design), construction of a manifold, air treatment disposal of the treatment wastes, and quarterly VOC monitoring. These factors, and the effectiveness of the technology for the area of concern would be evaluated by a pilot study. For purposes of the remedy at the Site, SVE would be combined with capping to enhance recovery efficiency.

#### Groundwater Alternatives.

MPA-G-1:	No Action
MPA-G-2:	Institutional Controls
MPA-G-4:	Natural Attenuation
MPA-G-5:	Groundwater Collection, Treatment & Discharge
MPA-G-6:	Groundwater Collection, Treatment of Source Area & Discharge

Alternative MPA-G-1:	No Action
Capital Cost:	\$0
Annual Operation and Maintenance:	\$0
Total Cost:	\$0

Under this alternative, no further effort or resources would be expended. Consideration of this alternative is required, as stated previously. A review of Site conditions would be required



every five years, since under this alternative, waste would be left in place.

Alternative MPA-G-2:	Institutional Controls
Capital Cost:	\$ 59,000
Annual Operation and Maintenance:	\$ 28,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 684,000

The purpose of institutional controls is to prevent the use of contaminated water-bearing units as a source of drinking water and/or to prevent the spread of contamination caused by groundwater pumping. Institutional controls protect human health to some degree by diminishing the potential for exposure. Key elements of this alternative include the legal requirements of the deed restrictions for groundwater use.

Alternative MPA-G-4:	Natural Attenuation
Capital Cost:	\$ 223,000
Annual Operation and Maintenance:	\$ 41,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 986,116

Natural attenuation relies upon naturally, occurring processes, particularly bioremediation, dilution, and dispersion to reduce concentrations of contaminants in the subsurface to below levels that pose little or no potential risk to human health and the environment. Under this alternative, groundwater samples are collected and analyzed for biological and chemical indicators to confirm contaminant biodegradation is reducing contaminant mass, mobility, and risk at an acceptable rate. Key elements of this alternative include construction of additional monitoring wells, monitoring for natural attenuation indicator parameters, preparation of trend analyses, and annual monitoring report preparation.

Alternative MPA-G-5:	Groundwater Collection, Treatment and Discharge
Capital Cost:	\$ 1,167,000
Annual Operation and Maintenance:	\$ 316,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 6,213,637

This alternative reduces the mass and concentration of contaminants in groundwater to MCLs by pumping and treating of groundwater at selected wells. A principal effect will be to reduce the extent of the existing plumes. The overall pumping rate, and the number, depth, and location of wells were selected to minimize the overall costs of treatment. The objective of this groundwater extraction system would be to contain the contaminant plume by pumping the extraction wells to keep the contaminant plume from migrating further from the Main Plant Area.

To achieve discharge limits, extracted groundwater would be treated on-Site using air stripping followed by either vapor phase activated carbon or U/V oxidation. After treatment of groundwater, the effluent would be discharged by one or a combination of the methods below.

- ò direct discharge to Valley Creek
- ò on-Site spray irrigation of forested areas
- ò re-injection to subsurface
- ò trucking to a Publicly Owned Treatment Works (POTW)
- ò discharge to a water purveyor (including the costs of a main extension by the purveyor).

Groundwater reinjection and spray irrigation are the most likely discharge alternatives due to

the Exceptional Quality designation of Valley Creek, the cost effectiveness of trucking discharge to a POTW, and the potential infeasibility of discharge to a water purveyor.

Alternative MPA-G-6:	Groundwater Collection, Treatment of Source Area, and Discharge
Capital Cost:	\$ 1,233,000
Annual Operation and Maintenance:	\$ 316,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 6,280,000

This alternative reduces mass and concentration of contaminants, similar to Alternative MPA-G-5; MPA-G-6 differs in the location of selected wells for groundwater withdrawal. This alternative requires pumping at the locations where Dense Non-Aqueous Phase Liquids (DNAPLs) are suspected. The strategy would be to collect contaminants in the dissolved phase along with any DNAPLs that are encountered. This pumping configuration would restore the groundwater to beneficial use. Groundwater treatment and discharge alternatives are the same as MPA-G-5 above.

#### FORMER DISPOSAL AREA/MOUNDED AREA

##### Soil Alternatives

FDA-S-1:	No Action
FDA-S-2:	Institutional Controls
FDA-S-3:	Capping
FDA-S-4:	Excavation, Off-Site Thermal Treatment, Disposal at a Subtitle C Landfill
FDA-S-5:	Excavation, ExSitu Volatilization, & Reuse as Backfill
FDA-S-6:	Excavation, On-Site Thermal Treatment, and Reuse as Backfill
FDA-S-7:	InSitu Soil Vapor Extraction
FDA-S-8:	Excavation, Consolidation of Soils at the Main Plant

Alternative FDA-S-1:	No Action
Capital Cost:	\$0
Annual Operation and Maintenance:	\$0
Total Cost:	\$0

Under this alternative, as stated previously, no further effort or resources would be expended.

Alternative FDA-S-2:	Institutional Controls
Capital Cost:	\$ 94,000
Annual Operation and, Maintenance:	\$ 56,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$1,150,000

The purpose of institutional controls is to prohibit temporarily or permanently certain activities on parts of the Site that contain hazardous materials. Institutional controls protect human health to some degree by diminishing the potential for exposure. Institutional Controls would include deed restrictions to limit future use of the Former Disposal Area and fencing to restrict access. Key elements of this alternative include the location and costs of the fencing and the legal requirements of the deed restrictions.

Alternative FDA-S-3:	Capping
Capital Cost:	\$ 434,000
Annual Operation and Maintenance:	\$ 30,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 974,285

The purpose of capping is to reduce potential leaching of contaminants in the unsaturated soil. This objective is accomplished by minimizing infiltration of rainfall and associated leaching of contaminants which are localized in the unsaturated soil zone. A gradual reduction in mass and concentration of contaminants in soil may occur as a result of natural attenuation processes. A cap can also be used to prevent exposure via direct contact with contaminated soils. Key elements of this alternative include grading, import of off-Site borrow material, installation of a clay, linear low density polyethylene membrane or bituminous concrete cap in the Former Disposal Area/Mounded Area, stormwater controls, soil vapor monitoring points and long-term monitoring.

#### Common Components for Alternatives FDA-S-4, FDA-S-5, FDA-S-6, and FDA-S-8

A common component for the excavation alternatives includes geoprobe exploration to more closely delineate volumes of soil which exceed clean up requirements, followed by excavation. Excavations will be above the water table and clean fill will be used to regrade the area. The principal factor for this alternative is the volume of material to be excavated. The volume of the excavated material was determined by the areal extent and depth of soils with contaminant concentrations which exceeded the clean up standards established for soil.

Alternative FDA-S-4:	Excavation, Off-Site Thermal Treatment, Disposal at Hazardous Waste Landfill
Capital Cost:	\$ 7,016,000
Annual Operation & Maintenance:	\$0
Total Cost:	\$ 7,016,000

The objective of excavation is to remove the mass of VOC contaminants in the vadose zone. Key elements of this alternative include geoprobe exploration, excavation and off-Site disposal to a hazardous waste landfill, backfilling, regrading, and land stabilization.

Alternative FDA-S-5:	Excavation, Ex-Situ Volatilization, and Re-Use as Backfill
Capital Cost:	\$ 2,351,000
Annual Operation and Maintenance:	\$ 390,000
Operation and Maintenance Period:	1 Year
Total Cost:	\$ 2,787,000

The objective of excavation is to remove the mass of VOC contaminants in the vadose zone. Key elements of this alternative include geoprobe exploration, excavation, ex-situ volatilization, re-use of treated soils as backfill, regrading, and land stabilization. Because the soils contain RCRA listed hazardous waste, once treated, soils must meet certain levels in order to place the soil back onto the ground. EPA has a "Contained-In Policy" which allows that soils contaminated with RCRA hazardous waste can be treated to certain site-specific levels that would allow such soils to be placed back onto the ground. A future pilot study would be required to determine if ex-situ volatilization can treat soils to these site-specific levels that render the soil non-hazardous and allow backfilling.

Alternative FDA-S-6:	Excavation, On-Site Thermal Treatment, and Re-Use as Backfill
Capital Cost:	\$ 3,858,000
Annual Operation and Maintenance:	\$0
Operation and Maintenance Period:	<1 Year
Total Cost:	\$ 3,858,000

The objective of excavation is to remove the mass of VOC contaminants in the vadose zone. Key elements of this alternative include geoprobe exploration, excavation, on-Site thermal desorption, re-use of treated soils as backfill, regrading, and land stabilization. Because the soils contain RCRA listed hazardous waste, once treated, soils must meet certain levels in order to place the soil back onto the ground. EPA has a "Contained-In Policy" which allows that soils contaminated with RCRA hazardous waste can be treated to certain site-specific levels that would allow such soils to be placed back onto the ground. A future pilot study would be required to determine if on-Site thermal treatment can treat soils to these site-specific levels that render the soil non-hazardous and allow backfilling.

Alternative FDA-S-7:	In-Situ Soil Vapor Extraction
Capital Cost:	\$ 1,308,000
Annual Operation and Maintenance:	\$ 581,560
Operation and Maintenance Period:	5 Years
Total Cost:	\$ 3,873,503

The objective of in-situ SVE is to reduce the mass and concentration of VOC contaminants in the vadose zone. SVE will greatly accelerate the rate at which the clean up levels can be attained. VOC contaminants will be removed from the subsurface soils. Key elements of this alternative include installation of extraction wells (the depth and number of wells will be determined during remedial design), air treatment, disposal of the treatment wastes, and quarterly VOC monitoring. The factors considered in sizing the treatment unit are the air conductivity of soil, mass of contaminants, and the concentration of VOCs recoverable in air. These factors were estimated for the FS. These factors would be evaluated by a future pilot study.

Alternative FDA-S-8:	Excavation with Consolidation at the Main Plant Area Corrective Action Management Unit (CAMU)			
	Option 1		Option 2	
Capital Cost:	\$ 684,319	Capital Cost:	\$ 777,762	
Annual O&M:	\$ 30,000	Annual O&M:	\$ 30,000	
O&M Period:	30 Years	O&M Period:	30 Years	
Total Cost:	\$ 1,242,924	Total Cost:	\$ 1,336,367	

The objective of this alternative is to remove contaminated soils from the Former Disposal Area/Mounded Area. The estimated 5,700 cubic yards of soil would be transported to the Main Plant Area and covered with a RCRA cap. Key elements of this alternative include geoprobe exploration, excavation and removal of contaminated soil to the Main Plant Area, removal of the collapsed quonset hut storage building, relocation of the office trailer, consolidation of soil and capping. In-situ treatment of contaminated soils by vapor extraction at the Main Plant Area was evaluated under Alternative MPA-S4 (In-Situ SVE). If Alternatives MPA-S-4 and FDA S-8 are both selected and pre-design pilot studies are favorable, the design of the In-Situ SVE system would be configured to treat soils transferred from the Former Disposal Area/Mounded Area to the Main Plant Area in addition to contaminated subsurface soils beneath source areas at the Main Plant Area.

Two options were evaluated for constructing a fill containing 5,700 cubic yards of contaminated soil. Option 1 involves razing and/or relocating several auxiliary structures at the Main Plant Area which are believed not to impact the current operation at the facility, including a former storage building which has collapsed in place, miscellaneous tanks and an office trailer. The completed fill would occupy approximately 0.43 acres and would have a maximum height of 20 feet with maximum side slopes of 2.5 to 1. This area would be capped separately from the proposed area in MPA-S3. Option 2 would require the razing of all existing structures at the Main Plant Area. Because Option 2 provides more surface area, the completed fill would occupy

0.8 acres and would rise a maximum of 7 feet above existing grade. The maximum side slopes for Option 2 would be 4: 1. If Option 2 were selected, the surface area of the cap would include the majority of the Main Plant Area and therefore the cap included under MPA-S3 would not be required and would result in a significant cost savings.

For both Options 1 and 2, the northern boundary of the capped fill lies over 30 feet inside the northern property line. Locating the fill in this manner will accommodate keeping the easement open between the Former Disposal Area/Mounded Area and Main Plant Area, and should prevent problems regarding access and easements if the property is ultimately sold. However, the exact area of the cap would be finalized during remedial design.

The concept of the RCRA Corrective Action Management Unit (CAMU) is a critical element to this alternative. The federal CAMU regulation, which was effective in April 1993, can be applicable to CERCLA sites. A CAMU is an area within a facility that is designated by the EPA Regional Administrator under 40 C.F.R. Part 264 subpart S, for the purposes of implementing corrective action. A CAMU shall only be used for the management of remediation waste.

In this alternative, a CAMU would be used to consolidate contaminated soil from the Former Disposal Area into a single area at the Main Plant Area. This action would enlarge the surface area affected by contaminated soil at the Main Plant Area but would have no impact on the groundwater clean up at the Main Plant Area. However, contaminated soil and remediation wastes would be effectively removed from the Former Disposal Area/Mounded Area which would reduce the timeframe for groundwater clean up at the Former Disposal Area. To comply with closure requirements, the relocated material would be covered with a RCRA cap.

#### Groundwater Alternatives

FDA-G-1:	No Action
FDA-G-2:	Institutional Controls
FDA-G-4:	Natural Attenuation
FDA-G-5:	Groundwater Collection, Treatment, and Discharge
FDA-G-6:	Groundwater Collection, Treatment (Single Well), and Discharge

Alternative FDA-G-1:	No Action
Capital Cost:	\$0
Annual Operation and Maintenance:	\$0
Total Cost:	\$0

Under this alternative, as stated previously, no further effort or resources would be expended on the groundwater at the Former Disposal Area.

Alternative FDA-G-2:	Institutional Controls
Capital Cost:	\$ 59,000
Annual Operation and Maintenance:	\$ 28,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 684,000

The purpose of institutional controls is to prevent the use of contaminated water-bearing units as a source of drinking water or to prevent the spread of contamination caused by groundwater pumping through administrative means. Institutional controls protect human health to some degree by diminishing the potential for exposure. Key elements of this alternative include the legal requirements of the deed restrictions for groundwater.

Alternative FDA-G-4:	Natural Attenuation
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Capital Cost:	\$ 227,000
Annual Operation and Maintenance:	\$ 42,000
Operation and Maintenance Period:	30 Years
Total Cost:	\$ 979,647

Contaminants are presently migrating within a groundwater plume toward Hillbrook Circle, located southwest of the Former Disposal Area/Mounded Area. A review of historical data indicates the area occupied by this plume has been at a steady-state or receding since drummed waste and contaminated soil were removed in the early 1980s (See Section II. Site History). Groundwater sampling and analysis has suggested that the contaminant plume was receding over this time period due to the drum and soil removal activities.

A receding contaminant plume occurs, in the absence of active remediation, when the rate of natural attenuation of contamination exceeds the rate at which contaminants enter the groundwater from a source. Typically, under receding conditions, the contaminant plume has expanded to a maximum extent and then the leading edge recedes as natural attenuation occurs along the periphery of the plume. The conditions at the Former Disposal Area/Mounded Area would suggest that the contaminant plume is approaching equilibrium with residual contamination which remains in the soil. The RI determined that there is significant evidence of biological and abiotic attenuation. Abiotic attenuation includes volatilization, sorption, hydrolysis, and dehalogenation. The solvents disposed at the Former Disposal Area/Mounded Area were primarily TCE, TCA, PCE, and MEC. However, other chlorinated species, including (cis)1,2-DCE, 1,1-DCE, and 1,1-DCA are present in approximately equal concentrations. These de-halogenated compounds are known to be degradation by-products of the more highly halogenated solvents which were disposed. Their presence in high concentrations indicates that the process of chemical degradation is advanced at the Former Disposal Area/Mounded Area. Under this alternative, groundwater samples are collected and analyzed for biological and chemical indicators to confirm contaminant biodegradation is reducing contaminant mass, mobility, and risk at an acceptable rate. Key elements of this alternative include construction of additional monitoring wells, quarterly monitoring for natural attenuation indicator parameters, preparation of trend analyses, and annual monitoring report preparation.

Alternative FDA-G-5:	Groundwater Collection, Treatment and Discharge
Capital Cost:	\$ 2,869,000
Operation and Maintenance:	\$ 2,898,000
Operation and Maintenance Period:	2 years
Total Cost:	\$ 8,258,000

This alternative includes the collection, on-Site treatment and discharge of contaminated groundwater at the Former Disposal Area/Mounded Area. Because of the large area of the plume (extending from the Former Disposal Area to the residential area), and the high transmissivity of the aquifer, selecting a well configuration to capture the complete plume would be difficult. Different scenarios were modeled, but recovery well locations that would de-water the residential wells were rejected. Modeling indicated that a pumping rate of 2,000 gallons per minute from the four extraction wells along the property boundary would prevent migration of the majority (approximately 80%) of the plume. Though some of the plume on the property and in the Hillbrook Circle would not be captured, the outlying plume area would be reduced by natural attenuation, especially when isolated from the source of higher levels of contamination. The existing wells are not capable of this yield and actual implementation of this alternative would require installation of larger diameter extraction wells.

Several methods of disposal of treated water, as discussed in Alternative MPA-G-5, were considered. Re-injection was considered most plausible, however, reinjection down gradient of the property could cause contamination to migrate to previously uncontaminated areas and

residences in Hillbrook Circle. Injection into eight wells upgradient of the extraction wells was determined to be more effective. This disposal method would help flush contaminants around monitoring well CC-14 toward the extraction wells. Extracted groundwater would be treated using air stripping combined with either activated carbon or U/V oxidation before re-injection. Clean up to MCLs is estimated to require two years.

Alternative FDA-G-6:                      Groundwater Collection (Single Well), Treatment, and Discharge

Capital Cost:	\$ 1,599,000
Annual Operation and Maintenance:	\$ 846,000
Operation and Maintenance Period:	7 Years
Total Cost:	\$ 3,269,802

This alternative includes the collection, on-Site treatment, and discharge of contaminated groundwater at the Former Disposal Area/Mounded Area. Alternative FDA-G-6 also relies on natural attenuation mechanisms to ultimately reduce groundwater contaminant concentrations below MCLs (5 ug/l for TCE). The intention of this alternative is to significantly reduce concentrations within the most highly contaminated portion of the plume. The pumping well would be shut off after two years and the plume would degrade to the MCL through natural attenuation.

In this alternative, contaminated groundwater would be intercepted at a single extraction well located downgradient of the Former Disposal Area/Mounded Area pumping at 500 gallons per minute. The exact location for the extraction well would be determined during design. Two wells could potentially be used if deemed necessary. Treated groundwater would be disposed by injecting groundwater in two injection wells located hydraulically upgradient of the Former Disposal Area/Mounded Area.

Results of the modeling indicated that concentrations in the central portion of the contaminant plume would decrease from greater than 1,000 ug/l to around 100 ug/l after two years of pumping. Concentrations in the central portion of the plume are estimated to reach the clean up level of 5 ug/l (MCL for TCE) in seven years.

Extracted groundwater would be treated at the plant with identical treatment and discharge processes as discussed for the Main Plant Area. The volume requiring treatment is estimated at 720,000 gallons/day.

#### IX. COMPARATIVE EVALUATION OF ALTERNATIVES

Each of the remedial alternatives summarized in this ROD has been evaluated against the nine (9) evaluation criteria set forth in the NCP, 40 C.F.R. Section 300.430(e)(9). These nine criteria can be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. A description of the evaluation criteria is presented below:

##### Threshold Criteria:

1. Overall Protection of Human Health and the Environment addresses whether a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled.
2. Compliance with ARARs addresses whether a remedy will meet all of the applicable, or relevant and appropriate requirements of environmental statutes. Preliminary ARARs each alternative are referenced in Appendix A1-A3 of the FS. ARARs for the Selected

Remedy are summarized in Table 14.

Primary Balancing Criteria:

3. Long-term Effectiveness refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once clean up goals are achieved.
4. Reduction of Toxicity, Mobility, or Volume through Treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume of contaminants.
5. Short-term Effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and environment that may be posed during the construction and implementation period until clean up requirements are achieved.
6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
7. Cost includes estimated capital, operation and maintenance costs, and present worth costs.

Modifying Criteria:

8. State Acceptance indicates whether, based on its review of backup documents and the Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.
9. Community Acceptance includes assessments of issues and concerns the public may have regarding each alternative based on a review of public comments received on the Administrative Record and the Proposed Plan.

Below is a summary of alternatives for reference during the comparative analysis:

Water Supply

WS-G-3a: Public Water Supply  
WS-G-3b: Well Head Treatment

Main Plant Area Soils

MPA S-1: No Action  
MPA S-2: Institutional Controls  
MPA S-3: Capping  
MPA S-4: InSitu Soil Vapor Extraction

Main Plant Area Groundwater

MPA-G-1: No Action  
MPA-G-2: Institutional Controls  
MPA-G-4: Natural Attenuation  
MPA-G-5: Groundwater Collection, Treatment & Discharge  
MPA-G-6: Groundwater Collection, Treatment of Source Area & Discharge



## Former Disposal Area Soils

FDA-S-1:	No Action
FDA-S-2:	Institutional Controls
FDA-S-3:	Capping
FDA-S-4:	Excavation, Off-Site Thermal Treatment, Disposal at a Subtitle C Landfill
FDA-S-5:	Excavation, ExSitu Volatilization, & Reuse as Backfill
FDA-S-6:	Excavation, On-Site Thermal Treatment, and Reuse as Backfill.
FDA-S-7:	InSitu Soil Vapor Extraction
FDA-S-8:	Excavation, Consolidation of Soils at the Main Plant

## Former Disposal Area Groundwater

FDA-G-1:	No Action
FDA-G-2:	Institutional Controls
FDA-G-4:	Natural Attenuation
FDA-G-5:	Groundwater Collection, Treatment, and Discharge
FDA-G-6:	Groundwater Collection, Treatment (Single Well), and Discharge

## Water Supply Alternatives

### 1. Overall Protection of Human Health and the Environment

Implementation of Alternatives WS-G-3a or WS-G-3b identified above would not protect human health or the environment at the Main Plant Area or the Former Disposal Area/Mounded Area (i.e., the source areas) because they do not address groundwater contamination on the property. The risk posed from contaminated soil and potential exposure to contaminated groundwater on these areas would not be reduced. Migration of contamination would continue through soil-contaminant leaching, groundwater migration, surface water migration, and infiltration. Residual risks for these areas are identical to those identified in the baseline risk assessment.

Implementation of WS-G-3a or WS-G-3b would protect human health at the residences by eliminating the potential for direct contact with contaminated groundwater by ingestion. Residential water would be treated to drinking water standards under WS-G-3b or supplied from a public water supply under WS-G-3a.

### 2. Compliance with ARARs

Requirements for the use of groundwater as a residential water supply include meeting Safe Drinking Water Act MCLs. For carcinogens, these requirements include treating groundwater at least to concentrations that do not cause a lifetime cancer risk greater than 1 in 10,000. For systemic toxicants, these requirements include treating groundwater to media specific levels where people could be exposed by direct ingestion or inhalation on a daily basis with no appreciable risk of deleterious effects.

Chemical-specific ARARs for this WS-G-3a or WS-G-3b would be met at the residences, but would not be met at the source areas.

The location-specific ARAR which applies to WS-G-3a or WS-G-3b is the Delaware River Basin Commission requirement which prohibits adverse impacts to the groundwater resources in the Delaware River Basin. This ARAR would be met at the residences, but not at the source areas.

There are no action-specific ARARS which apply to WS-G-3a or WS-G-3b.

### 3. Effectiveness and Permanence

Neither WS-G-3a or WS-G-3b provides long-term effectiveness and permanence within the source areas. The risk currently associated with the source areas would not be decreased and might be increased through migration of contaminants. Long-term risks posed by the source areas are described in the baseline risk assessment. Because of contaminants left at the Site, a review of Site conditions would be required every 5 years.

Alternative WS-G-3a and WS-G-3b would be effective in the long-term at protecting public health at the point of exposure. For well head treatment, maintenance and monitoring of carbon units would be necessary for the duration of well head treatment. However, connecting local residences to a water supply would provide long-term protection to public health at the point of exposure and would require the O&M to ensure long term effectiveness.

### 4. Reduction of Toxicity, Mobility, and Volume through Treatment

Neither WS-G-3a or WS-G-3b would provide any reduction of toxicity, mobility, and volume of contaminants at the source areas and would not meet the statutory preference for treatment. WS-G-3a and WS-G-3b would provide a reduction of toxicity and volume of contaminants at the residential water supplies. WS-G-3b would meet the statutory preference for treatment at the residences.

### 5. Short-Term Effectiveness

No increased risk to the surrounding community would be realized by implementation of either WS-G-3a or WS-G-3B at the source areas. This alternative would be effective immediately at the residences upon installation of the carbon units or water supply.

### 6. Implementability

WS-G-3a and WS-G-3b are both easily implementable. Equipment and services to install, monitor, and maintain the carbon units are available from local sources. Installation of a water main is already planned by the Philadelphia Suburban Water Company and is a standard construction activity. However, the implementability of these alternatives that require Institutional Controls may be affected due to legal considerations.

### 7. Cost

Evaluation of costs of each alternative generally includes the calculation of direct and indirect capital costs and the annual O&M costs, both calculated on a present worth basis.

Direct capital costs include costs of construction, equipment building and services, and waste disposal. Indirect capital costs include engineering expenses, start-up and shutdown, and contingency allowances. Annual O&M costs include labor and material; chemicals, energy, and fuel; administrative costs and purchased services; monitoring costs; cost for periodic Site review (every five years); and insurance, taxes, and license costs.

The total present worth costs of WS-G-3a is estimated at \$586,249 which is less expensive than WS-G-3b which is estimated at \$979,647.

### 8. Site Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, to the extent possible, the Commonwealth's comments have been incorporated into the ROD.

## 9. Community Acceptance

A public meeting on the Proposed Plan was held on July 16, 1997 at the Great Valley High School, East Whiteland Township, Pennsylvania. Comments received orally at the public meeting and in writing during the comment period were in favor of the provision of a public water supply for affected residents. Oral and written comments on the remedial alternatives evaluated by EPA for the implementation at the Site are included in Part III of this ROD.

## Main Plant Area - Soil Alternatives

### 1. Overall Protection of Human Health and the Environment

Alternative MPA-S-3, Capping, and Alternative MPA-S-4, In-Situ Soil Vapor Extraction (SVE) in combination, potentially achieve overall protection of human health and the environment. In the case of In-Situ SVE, effectiveness needs to be demonstrated through a treatability study. Alternative MPA-S-1, No Action, and Alternative MPA-S-2, Institutional Controls, would not be protective since clean up standards would not be met. Therefore, MPA-S-1 and MPA-S-2 will not be discussed further in this analysis since they do not meet this threshold criterion.

Alternative MPA-S-3, Capping, is the only alternative which would provide an immediate benefit by minimizing the release of contamination to groundwater from the contaminated soils in the unsaturated zone and protecting construction workers from direct contact with contaminated soils. The capping alternative also benefits In-Situ SVE, and several groundwater alternatives such as natural attenuation, conventional groundwater extraction, and DNAPL collection/groundwater extraction.

Alternative MPA-S-4, In-Situ SVE in combination with MPA-S-3, Capping, provides the largest reduction in soil migration and health-based risk on the Site through treatment of contamination above the clean up standards. The mass of contaminants in the soils would be reduced thereby and eliminate an ongoing source of contamination to groundwater.

### 2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARS)

Alternative MPA-S-3, Capping, and Alternative MPA-S-4, In-Situ SVE, would comply with chemical-, location-, and action-specific ARARS. A treatability study would be required for SVE to ensure that it can adequately achieve target clean up levels.

### 3. Long Term Effectiveness and Permanence

Alternative MPA-S-4, In-Situ SVE in combination with MPA-S-3, Capping, would be the most effective in the long-term since it incorporates treatment of the soil, which is not a reversible process and does not require long-term maintenance. A treatability study would be required.

Alternative MPA-S-3, Capping, would be effective in the long-term providing the O&M program and Institutional Controls are carried out. If the integrity of the cap is compromised, the contaminants in the underlying soil would be reactivated as a source of groundwater contamination and could lead to future exposures above the health-based risk standards.

#### 4. Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative MPA-S-4, In-Situ SVE in combination with MPA-S-3, Capping, provides the most significant reduction in toxicity, mobility, and volume in the source areas. Alternative MPA-S-3, Capping, provides a reduction in mobility, but does not provide a reduction in toxicity and volume on-Site.

#### 5. Implementability

This evaluation criterion addresses the difficulties and unknowns associated with implementing the clean up technologies associated with each alternative, including the availability of services and materials, and the reliability and effectiveness of monitoring. However, the implementability of any alternative that requires Institutional Controls may be affected due to legal considerations

Alternatives MPA-S-3 and MPA-S-4 are technically implementable. Alternative MPA-S-3, Capping, incorporates standard construction practices, including grading and paving for the concrete cap. An O&M program required for the cap incorporates standard construction practices. Alternative MPA-S-4, In-Situ SVE, incorporates standard construction practices. Routine O&M would include monthly sampling of extracted vapor and periodic changing of granular activated carbon for off-gas treatment.

Five year reviews would be required for Alternative MPA-S-3, Capping, since contaminated soils will remain on the Site. Five year reviews would be required for Alternative MPA-S-4, In-Situ SVE, during operation of the system.

#### 6. Short-Term Effectiveness

A temporary increase, in fugitive dust and construction traffic on nearby roads would occur during installation of the cap under Alternative MPA-S-3, Capping, Construction workers would be required to use personal protective equipment.

Alternative MPA-S-4, In-Situ SVE, would result in a temporary increase in fugitive emissions during construction and from treatment system operation. Off-gas from the treatment system would possibly require treatment. Construction workers would be required to use personal protective equipment.

#### 7. Cost

MPA-S-3 Capping, costs \$940,441 and is less expensive than MPA-S-4, In-Situ SVE, at\$2,351,189.

#### 8. State Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, to the extent possible, the Commonwealth's comments have been incorporated into the ROD

#### 9. Community Acceptance

A public meeting on the Proposed Plan was held on July 16, 1997 at the Great Valley High School, East Whiteland Township, Pennsylvania. Comments received orally at the public meeting and in writing during the comment period were generally in favor of installation of a cap over the Main

Plant Area. Comments were varied with respect to the implementation of SVE at the Main Plant Area. See Part III of this ROD for oral and written comments on the remedial alternatives evaluated by EPA for the implementation at the Site.

#### Main Plant Area - Groundwater Alternatives

##### 1. Protection of Human Health and Environment

Neither Alternative MPA-G-1, No Action, nor Alternative MPA-G-2, Institutional Controls, alone would provide overall protection of human health and the environment and will, therefore, not be discussed further in this analysis. Alternative MPA-G-2, Institutional Controls, may be a viable method to enhance the effectiveness of other alternatives. Alternative MPA-G-4, Natural Attenuation, may be effective in preventing the downgradient extension of the plume of contaminated groundwater. However, the data also indicates that the release of contaminants to groundwater is an on-going process at the Main Plant Area. Without other measures to control the sources of contamination, the plume is expected to persist for an extended period of time. Due to the apparent strength of the contaminant sources at the Main Plant Area, Alternative MPA-G-4, Natural Attenuation, cannot be relied upon to achieve MCLs and will, therefore, not be discussed further in this analysis.

Alternatives MPA-G-5 and G-6 are expected to achieve overall protection of human health and the environment.

##### 2. Compliance with ARARs

Alternative MPA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative MPA-G-6, Groundwater Collection, Treatment of Source Area, & Discharge, would comply with chemical-, location-, and action-specific ARARs.

##### 3. Long-Term Effectiveness and Permanence

Both Alternatives MPA-G-5 and MPA-G-6 would be the most effective in the long-term since they incorporate treatment of the groundwater, which is not a reversible process.

##### 4. Reduction of Toxicity, Mobility, and Volume through Treatment

Both alternative MPA-G-5 and MPA-G-6 provide the most significant reduction in toxicity, mobility, and volume at the source areas on the Chemclene property.

##### 5. Short-Term Effectiveness

A temporary increase in fugitive dust and construction traffic on nearby roads would occur during installation of the groundwater treatment system under Alternatives MPA-G-5 and MPA-G-6. Construction workers would be required to use personal protective equipment. A temporary increase in fugitive emissions during treatment system operation would occur. Off-gas from the treatment system may require treatment.

##### 6. Implementability

Alternatives MPA-G-5 and MPA-G-6 incorporate standard construction practices and equipment is readily available. However, the implementability of any alternative that requires Institutional Controls may be affected due to legal considerations.

Five year reviews would be required for Alternatives MPA-G-5 and MPA-G-6 during operation of the

systems.

#### 7. Cost

f MPA-G-5 and MPA-G-6, G-5 is slightly less costly (\$ 6,213,515) than G-6 (\$6,279,515).

#### 8. State Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, to the extent possible, the Commonwealth's comments have been incorporated into the ROD.

#### 9. Community Acceptance

A public meeting on the Proposed Plan was held on July 16, 1997 at the Great Valley High School, East Whiteland Township, Pennsylvania. Comments received orally at the public meeting and in writing during the comment period were varied with respect to the installation of a Pump and Treat System at the Main Plant. See Part III, Section II of the Responsiveness Summary for detailed written comments and EPA responses.

#### Former Disposal Area Soil Alternatives

##### 1. Overall Protection of human Health and the Environment

Alternative FDA-S-1, No Action, and Alternative FDA-S-2, Institutional Controls, alone would not be protective since remedial action objectives would not be met. These alternatives will not be discussed further in this comparative analysis; they have been screened out on this basis.

Alternatives FDA-S-3 through FDA-S-7 would provide overall protection of human health and the environment. In the case of ex-situ volatilization, on-Site thermal desorption, and In-Situ SVE, effectiveness needs to be demonstrated through a treatability study. FDA-S-8 would be protective of human health and the environment by removal of contaminated soils.

Alternatives FDA-S-3 through FDA-S-8 would provide an immediate benefit by minimizing the release of contamination to groundwater from the contaminated soils in the unsaturated zone and protecting humans from direct contact with contaminated soils.

Alternatives FDA-S-4 through FDA-S-8 provide the largest reduction in soil contamination and health-based risk on the Site through treatment of contamination above the clean up standards. The mass of contaminants in the soils would be reduced and the source of contamination to groundwater would be removed.

##### 2. Compliance with ARARs

Alternatives FDA-S-3 through FDA-S-8 comply with chemical-, location-, and action-specific ARARs. A treatability study would be required for ex-situ volatilization, on-Site thermal desorption, and In-Situ SVE (Alternatives FDA-S-5, FDA-S-6, and FDA-S-7) to ensure that the treatment systems can adequately comply with the clean up levels.

##### 3. Long-Term Effectiveness and Permanence

Alternatives FDA-S-3 through FDA-S-8 would be the most effective in the long-term since they incorporate treatment or removal of the soil, which is not a reversible process and does not

require long-term maintenance. A treatability study would be required for ex-situ volatilization, on-Site thermal desorption, and In-Situ SVE.

Alternative FDA-S-3, Capping, would be effective in the long-term if a cap O&M program is maintained. If the integrity of the cap is compromised, the contaminants in the underlying soil could be reactivated as a source of groundwater contamination, and lead to future exposures above the health-based risk standard.

#### 4. Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives FDA-S-4 through FDA-S-8, provide the most significant reduction in toxicity, mobility, and volume through treatment at the Former Disposal Area. Alternative FDA-S-3, Capping, does not employ treatment. The cap does provide a reduction in mobility, but does not provide a reduction in toxicity and contaminant volume.

#### 5. Short-Term Effectiveness

A temporary increase in air emissions and construction traffic on nearby roads would occur during installation of the bituminous concrete cap under Alternative FDA-S-3, Capping. Construction workers would be required to use personal protective equipment.

Alternatives FDA-S-4 through FDA-S-8 would result in a temporary increase in fugitive emissions during construction. Construction workers would be required to use personal protective equipment.

For Alternative FDA-S-5, Excavation, Ex-Situ Volatilization, Re-Use as Backfill, Alternative FDA-S-6, Excavation, On-Site Thermal Desorption, Re-Use as Backfill, and Alternative FDA-S-7, In-Situ SVE, off-gas from the treatment system would possibly require treatment.

#### 6. Implementability

All alternatives are technically implementable. However, implementability of any alternative that requires Institutional Controls may be affected due to legal considerations. Alternative FDA-S-3, Capping, incorporates standard construction practices, including grading and paving for the cap. An O&M program required for the cap incorporates standard construction practices.

Alternative FDA-S-4, Excavation, Off-Site Thermal Desorption, & Disposal at a Subtitle C Landfill, Alternative FDA-S-5, Excavation, Ex-Situ Volatilization, Re-Use as backfill, and Alternative FDA-S-6, Excavation, On-Site Thermal Desorption, Re-Use as backfill, and FDA-S-incorporation standard construction for excavation and backfill. A specialty contractor would be required for Alternative FDA-S-6, Excavation, On-Site Thermal Desorption, Re-Use as Backfill.

Alternative FDA-S-7, In-Situ SVE, incorporates standard construction practices. Routine O&M would include monthly sampling of extracted vapor and periodic changing of granular activated carbon for off-gas treatment.

Five year reviews would be required for FDA-S-3, Capping, since contaminated soils will remain on the Site. Five year reviews would be required for Alternative FDA-S-4, In-Situ SVE, during operation of the system.

#### 7. Cost

Alternative	Total Cost
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FDA-S-3	\$ 993,000
FDA-S-8	\$ 1,242,924
FDA S-5	\$ 2,787,000
FDA S-7	\$ 3,117,000
FDA S-6	\$ 3,858,000
FDA S-4	\$ 7,016,000

## 8. State Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, to the extent possible, the Commonwealth's comments have been incorporated into the ROD.

## 9. Community Acceptance

A public meeting on the Proposed Plan was held on July 16, 1997 at the Great Valley High School, East Whiteland Township, Pennsylvania. Comments received orally at the public meeting and in writing during the comment period were generally not in favor of EPA's proposed alternative FDA-S-8 for the Former Disposal Area soils. See Part III, Responsiveness Summary of this ROD for detailed comments and responses.

### Former Disposal Area Groundwater Alternatives

#### 1. Overall Protection of Human Health and Environment

Neither Alternative FDA-G-1, No Action, nor Alternative FDA-G-2, Institutional Controls, would provide long-term protection of human health and the environment. These will not be considered further.

Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, would achieve overall protection of human health and the environment by interception, removal and treatment of contaminated groundwater. Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Discharge, would achieve overall protection of human health and the environment by capturing the most contaminated part of the plume. The remaining plume would be reduced by natural attenuation.

#### 2. Compliance with ARARs

Alternative MPA-G-4, Natural Attenuation will comply with chemical-specific ARARs at the conclusion of the remedial action. Location-, and action-specific ARARs are not directly applicable for this alternative.

Alternative FDA-G-4, Natural Attenuation, has been shown to be effective in preventing the downgradient extension of the plume of contaminated groundwater. This alternative is a viable and effective solution which would satisfy the ARARs in the long-term.

Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Discharge, would comply with chemical-, location-, and action-specific ARARs.

#### 3. Long-Term Effectiveness and Permanence

Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative FDA-G-6,



Groundwater Collection (Single Well), Treatment, and Discharge, would be the most effective in the long-term since they incorporate removal and treatment of the groundwater, which is not a reversible process.

Alternative FDA-G-4, Natural Attenuation, may be effective in the long-term. Contamination would be remediated by natural attenuation mechanisms over time and the progress would be tracked by groundwater monitoring.

#### 4. Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative FDA-G-5, Groundwater Collection, Treatment and Discharge, and Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Discharge, provide the most significant reduction in toxicity, mobility, and volume at the source area of the Former Disposal Area. FDA-G-6 ultimately relies on natural attenuation mechanisms to degrade the contaminant plume below MCLs.

Reduction of toxicity, mobility, and volume for Alternative FDA-G-4, Natural Attenuation, is dependant on natural attenuation mechanisms such as biological and abiotic attenuation. Abiotic attenuation includes volatilization, sorption, hydrolysis, and dehalogenation.

#### 5. Short-Term Effectiveness

Alternative FDA-G-4, Natural Attenuation, involves no construction or Site activities and would therefore produce no disturbance to the surrounding community and environment.

A temporary increase in air emissions and construction traffic on nearby roads would occur during installation of the groundwater treatment system under Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Discharge. Construction workers would be required to use personal protective equipment. A temporary increase in fugitive emissions during treatment system operation would occur. Off-gas from the treatment system may require treatment.

#### 6. Implementability

All alternatives are technically implementable. However, the implementability of any alternative requiring Institutional Controls may be affected due to legal considerations. Alternative FDA-G-4, Natural Attenuation, is readily implemented. Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Discharge, incorporate standard construction practices and equipment is readily available.

Five year reviews would be required for Alternative FDA-G-4, Natural Attenuation since contaminated groundwater would remain on the Site. Five year reviews would be required for Alternative FDA-G-5, Groundwater Collection, Treatment, and Discharge, and Alternative FDA-G-6, Groundwater Collection (Single Well), Treatment, and Disposal, during operation of the systems or allowing the residual plume to degrade below MCLs.

#### 7. Cost

FDA-G-4 is the least expensive at \$979,647 followed by FDA-G-6 at \$3,272,000 and FDA-G-5 at \$8,258,000.

#### 8. State Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, to the extent possible, the Commonwealth's comments have been incorporated into the ROD.

#### 9. Community Acceptance

A public meeting on the Proposed Plan was held on July 16, 1997 at the Great Valley High School, East Whiteland Township, Pennsylvania. Comments received were varied with respect to installation of a pump and treat system at the Former Disposal Area. Oral and written comments on the remedial alternatives evaluated by EPA for the implementation at the Site are included in Part III of this ROD.

#### X. SELECTED REMEDY AND PERFORMANCE STANDARDS

Based upon considerations of the requirements of CERCLA, the detailed analysis of the alternatives using the nine criteria, and public comments, EPA has determined the following to be the most appropriate remedy for the Site:

- A. Water Supply: To prevent contact with groundwater contamination at residences affected or potentially affected by the Site, EPA has selected Alternative WS-G-3a, Public Water Supply.
- B. Main Plant Area Soils: To prevent direct contact with contaminated soils in the Main Plant Area and to reduce the potential for continued migration of these contaminants to the groundwater, EPA has selected Alternative MPA-S-3, Capping.
- C. Main Plant Area Groundwater: To restore the Site groundwater to beneficial use through removal and treatment of contaminated groundwater. EPA has selected Alternative MPA-G-6, Groundwater Collection, Treatment of Source Area, and Discharge.
- D. Former Disposal Area/Mounded Area Soils: To reduce the potential for continued migration of contaminants in these soils to the groundwater, EPA has selected Alternative FDA-S-4, Excavation, Off-Site Thermal Treatment, Disposal at a Hazardous Waste Landfill.
- E. Former Disposal Area/Mounded Area Groundwater: To reduce concentrations of contaminants in groundwater to MCLs, EPA has selected Alternative FDA-G-4, Natural Attenuation.

The detailed requirements and performance standards associated with the selected remedy are presented below.

- A. Water Supply Remedy and Performance Standards
  - 1. A source of potable water shall be provided year round to the residents listed in Table 14 by extending the existing waterline to the area of concern in the vicinity of the Site. The Philadelphia Suburban Water Company (PWSC) currently supplies water to East Whiteland Township, and has sufficient capacity at this time to provide water. PWSC plans to install water mains in Phoenixville Pike from Aston Road to Conestoga Road, and to extend the existing main in Conestoga Road north to Bacton Hill Road by the end of 1997. Therefore, this portion of the remedy addresses connections to the water mains that will be in place prior to the implementation of the remedy. To provide the water supply to the affected residents in Hillbrook

Circle, a secondary main will be required along with connections.

2. The water supply provided shall be in compliance with the Safe Drinking Water Act, 42 U.S.C. §§ 300(f)-300(j), and 40 C.F.R. § 141. The residences listed on Table 14 are those which EPA believes to have been impacted or have the potential to be impacted by the groundwater contamination from the Site. Approximately 52 residences are expected to be connected to the public water supply.
3. The water supply system shall be constructed in compliance with PSWC, State and local requirements. At a minimum, the water line shall be installed in a trench below the freeze line and independent connections shall be brought from the main into each residence. All areas impacted by construction activities shall be graded, restored, and revegetated, as necessary.
4. Independent connections shall be brought from the main into each residence affected or potentially affected by the contaminated groundwater.
5. Fire hydrants shall be installed in accordance with existing East Whiteland Township requirements along the main into Hillbrook Circle and along Phoenixville Pike.
6. Following hook up, costs of public water usage shall be the responsibility of the residence.
7. The installation of the water line shall avoid, minimize, and mitigate impacts on floodplains and wetlands. The performance standard will be in compliance with Executive Order No. 11988 and 40 C.F.R. Part 6, Appendix A (regarding avoidance, minimization, and mitigation of impacts on floodplains) and Executive Order No. 11990 and 40 C.F.R. Part 6, Appendix A (regarding avoidance, minimization, and mitigation of impacts on wetlands).
8. The existing residential wells shall be abandoned in accordance with the requirements of the Pennsylvania Safe Drinking Water Act 25 Pa. Code Section 109.62 and consistent with PADEP's Public Water Supply Manual, Part II, Section 3.3.5.11 and Chester County Health Department Rules and Regulations Chapter 500 unless selected by EPA for long-term monitoring. Existing carbon filters installed and/or maintained by EPA shall be removed from the residences.
9. RCRA listed constituents are present in the groundwater. Therefore, management of the spent filters shall be in accordance with the substantive requirements of 25 Pa. Code Chapter 262 Subparts A (relating to hazardous waste determination and identification numbers); B (relating to manifesting requirements for off site shipments of spent carbon or other hazardous wastes); and C (relating to pretransport requirements; 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements of 25 Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous waste generated as part of the remedy is managed in containers); 25 Pa. Code Chapter 264, Subpart J (in the event that hazardous waste is managed, treated, or stored in tanks), and 40 C.F.R. 268 Subpart C, Section 268.30, and Subpart E (regarding prohibitions on land disposal and prohibitions on storage of hazardous waste).
10. All areas impacted by the construction activities during remedy implementation shall be graded, restored and revegetated to the extent practicable.
11. The use of groundwater impacted by the Site shall be restricted through the

implementation of "Institutional Controls, as set forth in Section X.C.7 and E.7-12.

B. Main Plant Area Soils Remedy and Performance Standards

1. Cap: The Main Plant Area shall be capped with a final cover designed and constructed to provide long-term minimization of migration of liquids into the Main Plant Area soils. The cap shall function with minimum maintenance and include a drainage layer to promote drainage and minimize erosion. The cap shall shall accommodate settling and subsidence and consist of a Flexible Membrane Liner (FML) or equivalent that achieves a permeability less than or equal to  $1 \times 10^{-7}$  cm/sec. The cap shall also be designed to facilitate other components of the remedy including the groundwater extraction and treatment system. The design of the cap should consider the existing use of the property.

The cap shall be installed over all areas of the Main Plant Area with surface or subsurface soil contaminated above any of the following levels:

Contaminated	Soil Clean-up Standard (mg/kg)
Trichloroethene (TCE)	0.70
1,1-Dichloroethene (1,1-DCE)	0.05
1,1-Dichloroethane (1,1-DCA)	0.39
Tetrachloroethene (PCE)	1.22
Vinyl Chloride	0.01
Methylene Chloride	0.50
Benzene	0.38
Ethylbenzene	74.00
Toluene	9.47
Xylene	8,790.00

These levels are based on an amount of residual contamination that if left in the soil, would not cause the groundwater to be contaminated above Maximum Contaminant Levels. See FS, Appendix B. The exact location and extent of the capped area shall be determined during remedial design. Any existing equipment or aboveground storage tanks in the area where the cap shall be placed shall be removed to complete the cap construction in accordance with the requirements above.

2. An O&M program shall be implemented to maintain the integrity of the cap for a period of 30 years. Maintenance shall include repairs to the cap as necessary to maintain the permeability standard, correct any breaches, or any effects of settling, subsidence or erosion. An operation and maintenance plan for the cap will be required, and is subject to approval by EPA in consultation with the Commonwealth of Pennsylvania.
3. Structure Removal: The existing quonset hut structure (former container storage area) has collapsed and is no longer acting as a cap to the soils beneath it. Therefore, the collapsed quonset hut shall be decontaminated and removed. Once the structure is removed, a representative sample shall be collected to determine if the quonset hut debris is hazardous under RCRA. If hazardous, the quonset hut debris shall be decontaminated in accordance with the Hazardous Debris Rule and properly disposed of or reused.

Soil sampling shall be conducted beneath the quonset hut to determine if soils are impacted above any of the clean up levels listed in B.1 above. The cap shall be

extended to include this area, if soils are so impacted, and/or, in order to achieve the requirements set forth in (1) above.

4. Tank Removal:

Underground Storage Tanks

The former USTs previously excavated, and currently located on property adjacent to Chemclene, shall be decontaminated and properly disposed of or reused in accordance with RCRA. Representative samples shall be collected and analyzed to confirm decontamination. If the tanks continue to contain hazardous substances, they shall be shipped to a proper off-Site disposal facility in accordance with RCRA. If it is determined subsequent to decontamination that the tanks do not contain hazardous substances, the tanks may be reused or disposed offSite.

5. Main Building: The area occupied by the Main Building shall serve as a cap consistent with the Standards in (1) above. Presently, the building acts as a cap over an area of soils at the Main Plant. The building shall be inspected and maintained so as to reduce potential infiltration of precipitation to the extent possible and provide an effective cap over the soils at this area of the Site. If and when the building no longer reduces potential infiltration of precipitation and serves as an effective cap over the soils at the Main Plant Area, the building shall be removed, in accordance with the provisions set forth in this part.

In the event the building is removed, for any reason, soils beneath the removed building shall then be analyzed to determine if contamination is present above any of the clean up standards listed in B.1 above. If contamination is above clean up standards, the cap as set forth in (1), above shall be extended to cover this area.

6. Closure of the Main Building (including Loading Dock and Chemical Laboratory): The Main Building shall be closed in accordance with 25 Pa. Code 25 § 265.110 through 265.119, 265.442(7); 40 C.F.R. §§ 264.110 through 264.120, 264.178, 270.14(b)(13). Closure will consist of removal and proper disposal of all hazardous wastes; decontamination of the floor, related distillation equipment, contaminated structures (i.e. walls), and associated processing equipment. Contents of the building (i.e. process equipment, lab chemicals, etc.) shall be sampled to determine if hazardous substances are present. If hazardous substances are present, the material shall be shipped to a proper off-Site disposal facility in accordance with RCRA.
7. Wastewater generated during decontamination activities shall be properly managed in accordance with Pennsylvania Hazardous Waste Management regulations and/or the Clean Water Act.
8. Fugitive dust emissions generated during remedial activities will be controlled in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan (SIP) for the Commonwealth of Pennsylvania, 25 Pa. Code §§ 123.1 - 123.2 and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. §§ 50.6 and Pa. Code §§ 131.2 and 131.3.
8. The Main Plant Area perimeter fence shall be maintained to prevent trespassing and access to the Site during construction. The fence shall be maintained for 30 years to prevent unauthorized access to the capped area.
9. The cap shall not be breached or adversely affected. The capped area may continue to be used for commercial operations or other activities as long as the cap is not adversely affected. Institutional Controls shall be implemented to accomplish this.

C. Main Plant Area Groundwater Remedy and Performance Standards

1. Groundwater Remediation

The groundwater affected by contamination originating at the Main Plant Area shall be remediated through extraction and treatment. Extraction well(s) shall be designed to remediate the dissolved contaminant plume to MCLs listed in C.2 below. The exact number and location of extraction well(s) shall be determined during the remedial design phase. The degree to which natural attenuation can be incorporated into the pump and treat system will be determined during remedial design. A portion of the extraction system shall be positioned to collect potential DNAPLs in the area of existing monitoring wells CC-6 and CC-7. DNAPLs shall be contained if present, extracted to the degree practicable, and disposed of off-Site.

2. Groundwater Treatment

a) The groundwater plume at the Main Plant Area shall be remediated until the MCL or the non zero MCLG (whichever is more stringent) for all the contaminants of concern [40 C.F.R. part 141] is achieved. Since most CoPCs at the Site are members of the same general class of chemicals and possess similar physical and chemical properties, the selected treatment remedy at the Site will likely reduce or eliminate all contaminants posing potential risks. The performance standards for the contaminants in the groundwater at the Main Plant Area are listed below:

Contaminant	MCL (ug/l)	MCLG (ug/l)
Chloroform	100	0
Trichloroethene(TCE)	5	0
1,1-Dichloroethene(1,1-DCE)	7	7
1,2-Dichloroethane(1,2-DCA)	5	0
Tetrachloroethene(PCE)	5	0
Vinyl Chloride	2	0

b) Recovered groundwater shall be treated and reduced to MCLs via air stripping followed by vapor phase granular activated carbon or U/V oxidation prior to reinjection. The treatment system shall reduce the contaminants in the extracted groundwater, unattended, on a continuous, 24-hour-per-day performance basis. A treatment plant shall be capable of handling high contaminant concentrations because of the potential presence of DNAPLs. A pilot study shall be conducted to determine the appropriate treatment method to conform with drinking water standards. The final pumping rate and the exact location, size, and number of extraction wells shall be determined during remedial design. Final design criteria for the air stripper treatment system will be determined by EPA in consultation with PADEP. The design, construction and operation of the treatment system shall consider and reduce the possible visual and noise impacts to the surrounding residences. The design, construction and operation of the treatment system shall be in harmony with the surrounding community to the extent practicable.

c) The treated groundwater effluent shall be discharged to reinjection wells located to maximize the performance of the remedy in 2.a above. The treated groundwater effluent shall be reinjected in accordance with "Applicability of Land Disposal Restrictions to RCRA and CERCLA Groundwater Treatment Reinjection", OSWER Directive #9234.1-06. The final number of injection wells, and their locations and configurations, shall be determined in a pre-design study.

d) Any VOC emissions from the air stripper tower will be in accordance with the

Pennsylvania Department of Environmental Protection air pollution regulations outlined in 25 Pa. Code §§ 121.1 - 121.3, 121.7, 123.1, 123.2, 123.31, 123.41, 127.1, 127.11, 127.12, and 131.1 - 131.4. 25 Pa. Code § 127.12 requires all new air emission sources to achieve minimum attainable emissions using the best available technology, (BAT). In addition, the PADEP air permitting guidelines for remediation projects require all air stripping and vapor extraction units to include emission control equipment. Federal Clean Air Act requirements, 42 U.S.C. §§ 7401 et seq, are applicable and must be met for the discharge of contaminants to the air. Air permitting and emissions ARARs are outlined in 40 C.F.R. §§ 264.1030 - 264.1034 (Air Emissions Standards for Process Vents), and 40 C.F.R. §§ 264.1050 - 264.1063 (Air Emissions Standards for Equipment Leaks). Air emissions of vinyl chloride will comply with 40 C.F.R. Parts 61.60 - 61.69, National Emission Standards for Hazardous Air Pollutants (NESHAPS). OWSEER Directive #9355.0-28, Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites, is a "to be considered" (TBC) requirement.

e) Management of waste from the operation of the treatment system (i.e. spent carbon units, DNAPLs) shall comply with the requirements of 25 Pa. Code Chapter 262 Subparts A (relating to hazardous waste determination and identification numbers); B (relating to manifesting requirements for off site shipments of spent carbon or other hazardous wastes); and C (relating to pretransport requirements); 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements of 25 Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous waste generated as part of the remedy is managed in containers); 25 Pa. Code Chapter 264, Subpart J (in the event that hazardous waste is managed, treated or stored in tanks); and 40 C.F.R. 268 Subpart C, Section 268.30, and Subpart E (regarding prohibitions on land disposal and prohibitions on storage of hazardous waste).

3. The extraction and treatment system shall avoid, minimize, and mitigate impacts on floodplains and wetlands. The performance standard will be in compliance with Executive Order No. 11988 and 40 C.F.R. Part 6, Appendix A (regarding avoidance, minimization and mitigation of impacts on floodplains) and Executive Order No. 11990 and 40 C.F.R. Part 6, Appendix A (regarding avoidance, minimization, and mitigation of impacts on wetlands).
4. Fugitive dust emissions generated during remedial activities will be controlled in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan (SIP) for the Commonwealth of Pennsylvania, 25 Pa. Code §§ 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. §§ 50.6 and Pa. Code §§ 131.2 and 131.3
5. The extraction and reinjection systems shall achieve the substantive requirements of the Delaware River Basin Commission (DRBC) (18 C.F.R. Part 430). These regulations establish requirements for the extraction and discharge of groundwater within the Delaware River Basin. However, modifications to the Selected Remedy as a result of the DRBC requirements are not anticipated.
6. Monitoring
  - a) The performance of the extraction and treatment system shall be monitored through the use of monitoring wells. EPA, in consultation with PADEP, will determine if additional monitoring wells are necessary to determine the extent of the groundwater plume or performance of the system.
  - b) At least one round of samples shall be collected from existing Site monitoring wells

as well as any additional monitoring wells installed, during the predesign phase, and analyzed for VOCs, in order to determine the extent of groundwater contaminant plume at that time. Any new wells installed must be drilled in accordance with 25 Pa. Code Chapter 107. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S. § 645.1 et seq.

c) An operation and maintenance plan shall be developed for the groundwater extraction system during the remedial design phase. The operation and maintenance plan shall be developed and implemented to determine the operation and performance of the system within design criteria and achievement of performance standards. At a minimum, the influent and effluent from the treatment facility shall be sampled twice per month for VOCs. Operation and maintenance of the groundwater extraction system shall continue for an estimated 30 years or such other time period as EPA, in consultation with PADEP, determines to be necessary, based on the statutory reviews of the remedial action conducted every five years from the initiation of the remedial action. The performance of the groundwater extraction and treatment system shall be carefully monitored on a regular basis, as described below in the Section 6.g of this Selected Remedy. The system may be modified, as warranted by performance data during operation to achieve Performance Standards. These modifications may include for example, alternate pumping of extraction well(s), the addition or elimination of certain extraction wells and, changes in reinjection location.

d) The operation and maintenance plan shall be revised after construction of the treatment system has been completed if it is determined to be necessary by EPA.

e) Five year statutory reviews under Section 121(c) of CERCLA shall be required, as long as hazardous substances remain on-Site and prevent unlimited use and unrestricted access to the Site. Five year reviews shall be conducted at the initiation of the remedial action in accordance with EPA guidance document, Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23, 1991).

f) Existing pumping and/or monitoring wells which serve no useful purpose shall be properly plugged and abandoned consistent with PADEP's Public Water Supply Manual, Part II, Section 3.3.5.11 and Chester County Health Department Rules and Regulations Chapter 500, in order to eliminate the possibility of these wells acting as a conduit for future groundwater contamination. Wells which EPA determines are necessary for use during the long term monitoring program will not be plugged.

g) A long-term groundwater monitoring program shall be implemented to evaluate the effectiveness of the groundwater extraction and treatment system at the Main Plant Area.

i) The plan for the long-term groundwater monitoring program shall be included in the operation and maintenance plan for the groundwater extraction and treatment system. The plan shall include the sampling of a sufficient number of wells to monitor the effectiveness of the remedial action. EPA, in consultation with PADEP, will determine the number and location of monitoring wells necessary to verify the performance of the remedial action.

ii) The installation of additional monitoring wells will be required. Numbers and locations of these monitoring wells shall be determined by EPA during the remedial design, in consultation with the PADEP.

iii) The wells shall be sampled quarterly for the first three years. Based on



the findings of the first three years of sampling, the appropriate sampling frequency for subsequent years will be determined by EPA, in consultation with the PADEP.

iv) Sampling and operation and maintenance shall continue until such time as EPA, in consultation with PADEP, determine that the performance standard for each contaminant of concern has been achieved throughout the entire area of groundwater contamination.

v) If EPA, in consultation with PADEP, makes such determination, the wells shall be sampled for twelve consecutive quarters throughout the entire plume and if contaminants remain at or below the performance standards, the operation of the extraction system shall be shut down.

vi) Annual monitoring of the groundwater shall continue for five years after the system is shutdown.

vii) If subsequent to an extraction system shutdown, annual monitoring shows that groundwater concentrations of any contaminant of concern are above the Performance Standard set forth above, the system shall be restarted and continued until the performance standards have once more been attained for twelve consecutive quarters. Annual monitoring shall continue until EPA determines, in consultation with the PADEP, that the Performance Standards in 2.a above for each contaminant of concern has been achieved on a continuing basis.

#### 7. Institutional Controls

No newly commenced or expanded groundwater pumping in the aquifer shall be implemented which will adversely affect the plume migration. The Site shall be identified as property underlain by contaminated groundwater. Human consumption of contaminated groundwater shall be prevented. Institutional Controls shall be implemented to achieve these items.

#### D. Former Disposal Area/Mounded Area Soils Remedy and Performance Standards

1. All soils with contaminant concentrations exceeding any of the following soil clean-up performance standards shall be excavated and removed from the Former Disposal Area/Mounded Area:

Contaminant	Soil Clean-up Standard (mg/kg)
Trichloroethylene (TCE)	0.70
1,1-Dichloroethene (1,1-DCE)	0.05
1,1-Dichloroethane (1,1-DCA)	0.39
1,1,1 Trichloroethane (1,1,1 TCA)	45.00
Tetrachloroethene (PCE)	1.22
Vinyl Chloride	0.01
Methylene Chloride	0.50
PCBs	1.00

Since most CoPCs at the Site are members of the same general class of chemicals and possess similar physical and chemical properties, the selected remedy at the Site will likely reduce or eliminate all contaminants posing potential risks. An estimated 5,700 cubic yards of soil with contaminant concentrations exceeding the above performance

standards is present at the Former Disposal Area/Mounded Area. Additional sampling shall be performed during the remedial design to determine the full extent of required excavation of the subsurface soil contamination. During the previous investigations at the Former Disposal Area/Mounded Area, low level PCB contamination was detected in surface samples, however, subsurface soils were not fully characterized for PCBs during the RI. Therefore, any sampling conducted during the remedial design will require PCB analysis. The number and location of the soil samples, the analytical parameters, and methods will be determined by EPA, in consultation with PADEP, during the remedial design phase.

2. Structural stability of open excavations shall be maintained with temporary shoring or engineering measures as appropriate. Excavation will begin using a backhoe, and the sides of the excavation area shall be cut back to a minimum 2 to 1 slope to prevent side wall failure. Air monitoring shall be conducted during excavations to ensure safety of Site workers and nearby residents living in the vicinity of the Site.
3. Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather consistent with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual. Erosion potential shall be minimized. Further, controls in the form of Site grading to improve land grades, cover soils, vegetation, and drainage channels to reduce erosion potential from surface runoff may be required to minimize erosion. Contaminated soils shall be prevented from being washed into on-Site surface water and adjacent uncontaminated and uncontrolled wetland areas during remedial action implementation. The extent of erosion control necessary will be determined by EPA, in consultation with the PADEP, during the remedial design phase.
4. Post-excavation sampling will be performed after the excavation is completed. Post-excavation samples will be obtained from the base and the sidewalls of the excavation to ensure that contamination is not present above the soil clean-up Performance Standards specified in D.1. The location of the post-excavation samples will be selected based on visual observation of lithology and screening for VOCs using an appropriate organic vapor detector. The samples will be analyzed for VOCs, and PCBs on a quick turnaround basis using a method approved by EPA.
5. If the post-excavation sample concentrations are below all the clean-up levels, the excavation will be backfilled using clean soil. Clean borrow material will be brought in to restore the excavation to original grade. Backfilling will be performed, and the material will be compacted to minimize the potential for subsidence. The excavation area shall be covered with a layer of cover soil and revegetated with native plant material until a viable cover is established. Any on Site landscaping will be in accordance with Office of the Federal Executive; Guidance for Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds, 60 Fed. Reg. 40837 (August 10, 1995) which is a "to be considered" (TBC) requirement.
6. If VOCs or PCBs are detected at levels above any of the soil clean up Performance Standards in the post-excavation samples, additional material will be removed from the excavation area and new samples obtained for analysis as discussed in D.1. Excavation and sampling activities will continue until the results indicate that the soils do not contain contaminants of concern above any of the performance standards. The excavation area will then be restored as described in D.5.
7. RCRA listed constituents will exist in the excavated soil, therefore, the remedy will

be implemented consistent with the following substantive requirements, which are applicable to on-Site, activities, of Pa. Code °° 262.11 - 262.13 (relating to hazardous, waste determination and identification numbers), 25 Pa. Code ° 262.34 (relating to pretransport requirements); 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements of 25 Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous waste is generated as part of the remedy).

8. Fugitive dust emissions generated during remedial activities will be controlled in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan (SIP) for the Commonwealth of Pennsylvania, 25 Pa. Code °° 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. °° 50.6 and Pa. Code °° 131.2 mid 131.3

E. Former Disposal Area/Mounded Area Groundwater Remedy and Performance Standards

1. A Natural Attenuation groundwater monitoring program shall be implemented to determine that natural attenuation is occurring, and that the groundwater plume will not enlarge or migrate into areas not presently affected by the source area at the Former Disposal Area/Mounded Area. Monitoring shall be conducted until the MCL or the non-zero MCLG for all the the contaminants of concern [40 C.F.R. part 141] whichever is more stringent is achieved. Since most CoPCs at the Site are members of the same general class of chemicals and possess similar physical and chemical properties, the selected remedy at the Site will likely reduce or eliminate all contaminants posing potential risks.

The performance standard for the contaminants in the groundwater are listed below:

Contaminant	MCL (ug/l)	MLCG (ug/l)
Chloroform	100.00	0
Trichloroethene	5.0	0
1,1-Dichloroethene (1,1-DCE)	7.0	2
1,2-Dichloroethane (1,2-DCA)	5.0	0
Tetrachloroethene (PCE)	5.0	0

2. The Natural Attenuation program shall include the sampling to monitor the effectiveness of the Natural Attenuation program. Monitoring shall include sampling of the groundwater discharging to Valley Creek and surface water within Valley Creek to ensure that the groundwater plume does not impact the creek. The necessary monitoring shall be determined during Remedial Design and shall be provided in a Natural Attenuation Monitoring Plan. EPA, in consultation with PADEP, will determine the number and location of monitoring wells, number and location of creek samples, and monitoring parameters necessary to verify the performance of the remedial action. Installation of additional wells may be necessary and must be in accordance with 25 Pa. Code Chapter 107. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S.° 645.1 et seq.
3. The wells and creek sampling points shall be sampled quarterly for the first three years. The samples shall be analyzed for VOCs and natural attenuation parameters at each sampling location. The natural attenuation parameters will be determined by EPA in consultation with PADEP during Remedial Design. Based on the findings of the first three years of sampling, the appropriate sampling frequency for subsequent years will be determined by EPA in consultation with the PADEP.

4. Monitoring shall continue until such time as EPA, in consultation with PADEP, determine that the performance standard for each contaminant of concern has been achieved. If EPA and the Commonwealth make such a determination, the wells shall be sampled for twelve consecutive quarters throughout the entire plume and if contaminants remain at or below the performance standards, the monitoring program shall be discontinued.
5. Five year statutory reviews under Section 121 (c) of CERCLA will be required, as long as hazardous substances remain onsite and prevent unlimited use and unrestricted access to the Site. Five year reviews shall be conducted at the initiation of the remedial action in accordance with EPA guidance document, Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23, 1991).
6. Existing monitoring wells which serve no useful purpose shall be properly plugged and abandoned consistent with PADEP's Public Water Supply Manual, Part II, Section 3.3.5.11 and Chester County Health Department Rules and Regulations Chapter 500, in order to eliminate the possibility of these wells acting as a conduit for future groundwater contamination and to prevent adverse impacts to the remedy. Wells which EPA determines are necessary for use during the long term monitoring program will not be plugged.
7. No newly commenced or expanded groundwater pumping in the aquifer shall be implemented which will adversely affect the plume migration. Institutional controls will be used to identify the Site as property underlain by contaminated groundwater, and to prevent the human consumption of contaminated ground water.
8. Drinking water supply wells shall not be installed in the area of the contaminated groundwater plume.
10. No new development at or near the Site shall adversely affect the natural hydraulic containment and plume migration.
11. Title restrictions along with other appropriate means shall be used to implement the requirements above.
12. Title restrictions will be appropriately recorded with the Chester County Recorder of Deeds.

#### FUTURE POSSIBLE CHANGES IN ACCORDANCE WITH NCP

##### Groundwater Extraction and Treatment System

It may become apparent during implementation or operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than Performance Standards over some portion of the contaminant plume originating from the Main Plant Area. If EPA, in consultation with PADEP, determines that implementation of the selected remedy demonstrates, in corroboration with hydrogeological and chemical evidence, that it will be technically impracticable to achieve and maintain the Performance Standards throughout any part of the contaminant plume, EPA, in consultation with PADEP, may require that any or all of the following measures be taken, for an indefinite period of time, as further modification(s) of the existing system:

- a) long-term gradient control provided by modified pumping, as a containment measure;

b) chemical-specific ARARs may be waived for those portions of the aquifer that EPA determines, in consultation with PADEP, are technically impracticable to achieve. Such determinations shall be reevaluated at each subsequent five-year review;

c) institutional controls may be provided/maintained to restrict access to those portions of the aquifer where contaminants remain above performance standards; and

d) remedial technologies for groundwater restoration may be reevaluated.

The decision to invoke any or all of these measures may be made during implementation or operation of the remedy or during the 5-year reviews of the remedial action. If such a decision is made, EPA shall amend the ROD or issue an Explanation of Significant Differences.

#### Natural Attenuation

It may become apparent during implementation of the Natural Attenuation program that contaminant levels have ceased to decline and are remaining constant at levels higher than Performance Standards over some portion of the contaminant plume. EPA, in consultation with PADEP, may require that any or all of the following measures be taken, for an indefinite period of time, as further modification(s) of the remedial action:

a) chemical-specific ARARs may be waived for those portions of the aquifer that EPA determines, in consultation with PADEP, are technically impracticable to achieve. Such determinations shall be reevaluated at each subsequent five-year review;

b) institutional controls may be provided/maintained to restrict access to those portions of the aquifer where contaminants remain above performance standards; and

c) remedial technologies for groundwater restoration may be reevaluated.

The decision to invoke any or all of these measures set forth above may be made during implementation or operation of the remedy or during the 5-year reviews of the remedial action. If such a decision is made, EPA shall amend the ROD or issue an Explanation of Significant Differences.

### XI. STATUTORY DETERMINATIONS

The following sections discuss how the selected remedy for the Malvern TCE Site meets these statutory requirements.

#### A. Protection of Human Health and the Environment

Based on the Baseline Human Health Risk Assessment for the Site, measures should be considered to reduce potential risk from the following sources: (1) VOCs in the groundwater and (2) VOCs in subsurface soils. These media and contaminants were selected because potential health hazards for some exposure scenarios exceeded the EPA target range of  $1.0 \times 10^{-4}$  (or 1 in 10,000), and  $1.0 \times 10^{-6}$  (or 1 in 1,000,000) for lifetime cancer risk or a non-cancer Hazard Index of one (1). The results of the Ecological Risk Assessment show the potential for risk to ecological receptors; however, the selected remedy will address this concern.

The extension of a public water supply called for in the selected remedy will provide a permanent alternative water supply to affected and potentially affected residences and businesses which will prevent current human exposure to groundwater contaminants. However, it will not actively reduce the contaminants in the soil or groundwater, or prevent migration of

contaminated groundwater from the source areas of the Site.

The installation of a cap over soil at the Main Plant Area will reduce the infiltration of precipitation, thereby eliminating the potential for contaminant migration to the groundwater and preventing future exposure through ingestion, inhalation and dermal contact of groundwater.

The selected remedy protects human health and the environment at the Main Plant Area of the Site by reducing levels of contaminants in the groundwater to those levels required by ARARs through extraction and treatment. The groundwater extraction and treatment system shall reduce the levels of contaminants of concern in the groundwater to achieve MCLs as required by the Safe Drinking Water Act, 42 U.S.C. § 300(f) - 300(j), and 40 C.F.R. § 141.61. Reinjection of treated groundwater will not adversely affect human health or the environment, provided that all Performance Standards and ARARs are met.

The excavation of soil at the Former Disposal Area will protect human health and the environment by removing the contaminated soil, thereby eliminating the potential for contaminant migration to the groundwater and preventing future exposure through ingestion, inhalation and dermal contact.

The selected remedy protects human health and the environment at the Former Disposal Area by reducing levels of contaminants in the groundwater to those levels required by ARARs through Natural Attenuation. Natural Attenuation shall reduce the levels of contaminants of concern in the groundwater to achieve MCLs as required by the Safe Drinking Water Act, 42 U.S.C. § 300(f) - 300(j), and 40 C.F.R. § 141.61. Reinjection of treated groundwater will not adversely affect human health or the environment, provided that all Performance Standards and ARARs are met.

Implementation of the selected remedy will not pose any unacceptable short term risks or cross media impacts to the Site, or the community.

B. Compliance with and Attainment of Applicable or Relevant and Appropriate Requirements ("ARARs")

The selected remedy will comply with all applicable or relevant and appropriate chemical-specific, location-specific and action-specific ARARs as discussed above in Section X of this ROD and summarized on Table 13.

C. Cost-Effectiveness

The selected remedy is cost-effective in providing overall protection in proportion to cost, and meets all other requirements of CERCLA. Section 300.430(f)(ii)(D) of the NCP requires EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria - protection of human health and the environment and compliance with ARARs - against three additional balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness. The selected remedy meets these criteria and provides for overall effectiveness in proportion to its cost.

D Water Supply: Alternative WS-G-3a, Public Water Supply, \$505,971.

D Main Plant Area Soils: Alternative MPA-S-3, Capping, \$940,441.

D Main Plant Area Groundwater: Alternative MPA-G-6, Groundwater Collection, Treatment of Source Area, and Discharge, \$6,280,000.

D Former Disposal Area/Mounded Area Soils: Alternative, FDA-S-4, Excavation, Off-

Site Thermal Treatment, Disposal at a Hazardous Waste Landfill, \$7,016,000.

**D** Former Disposal Area/Mounded Area Groundwater. FDA-G-4, Natural Attenuation, \$786,739.

The combined estimated present worth cost for the selected remedy presented in this Record of decision is \$15,529,151. The proposed plan estimated that the preferred alternative would cost \$14,592,000. The difference in estimated costs from the Proposed Plan to this ROD is primarily due to the-remedy changes outlined in Section XII of this ROD (page 67).

**D.** Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized while providing the best balance among the other evaluation criteria. Of those alternatives evaluated that are protective of human health and the environment and meet ARARs, the selected remedy provides the best balance of tradeoffs in terms of long-term and short-term effectiveness and permanence, cost effectiveness, implementability, reduction in toxicity, mobility, or volume through treatment, State and community acceptance, and preference for treatment as a principal element.

Under the selected remedy, groundwater extraction through source and migration control wells and treatment of groundwater using air stripping is more cost-effective than the other alternatives evaluated. The selected remedy will reduce contaminant levels in the Class IIA aquifer, a known source of drinking water, and reduce the risks associated with ingestion and inhalation of the groundwater to the maximum extent practicable, as well as provide long-term effectiveness.

The selection of excavation and off-Site disposal of contaminated soils at the FDA, provides the best balance of trade offs among the nine NCP selection criteria. The remedy provides the highest degree of long-term effectiveness and permanence, reduces mobility and reduces risk to human health and the environment.

The selected remedy for the Main Plant Area provides the highest feasible degree of long-term effectiveness and permanence, reduces mobility and reduces risk to human health and the environment. Cleanup of Main Plant Area soils is particularly challenging since they contain high levels of complex contamination down to 100 feet deep (see section VI.A, pp. 6 - 9). Accordingly, the alternatives of excavation and off-site treatment and disposal, or, several possible in-situ treatment methods for these soils, were considered infeasible and screened out during the Feasibility Study. Soil vapor extraction (SVE) was evaluated carefully by EPA, as Alternative MPA-S-4. However, EPA concluded that although it may have been possible to remediate some of these soils using this method, the selected remedy of capping provides an equivalent level of protection and long-term effectiveness. The soil capping remedy will be combined with long-term institutional controls and a groundwater remedy designed to achieve and maintain MCLs. An on-going business also operates in the area of the soil contamination. EPA therefore has attempted to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for the unique conditions at the Main Plant Area.

**E.** Preference for Treatment as a Principal Element

The selected remedy satisfies, in part, the statutory preference for treatment as a principal element. The contaminated groundwater alternative (MPA-G-6) addresses the primary threat of future ingestion and inhalation of contaminated groundwater through treatment using air stripping. In addition, the soils at the Former Disposal Area/Mounded Area will be treated off-Site prior to disposal.

## XII. DOCUMENTATION OF CHANGES FROM PROPOSED PLAN

The Proposed Plan identifying EPA's preferred alternative for the Site was released for comment on June 23, 1997. During the public comment period, EPA received numerous comments from the responsible parties and local community regarding EPA's Proposed Remedy. The changes discussed below are detailed in Part III of this ROD. (See Part III of this ROD) The selected remedy described in this ROD differs from the remedy in the Proposed Plan with regard to the following:

1) Main Plant Area Soils: EPA has reconsidered adoption of SVE at the Main Plant Area soils. EPA believes that although it may have been possible to remediate some of the soils at the Main Plant, the selected remedy (S-3, Capping) provides an equivalent level of protection and long-term effectiveness as the originally proposed remedy, while being more cost effective.

2) Former Disposal Area/Mounded Area Soils: EPA has reconsidered the movement of contaminated soils from the Former Disposal Area/Mounded Area to the Main Plant Area for consolidation. As a result, EPA has modified the preferred remedy and has selected FDA-S-4, Excavation, Off-Site Thermal Treatment and Disposal at a Hazardous Waste Treatment and Disposal Facility. Although the selected remedy for the soils is more costly than EPA's originally preferred remedy, EPA believes this modification provides the best balance of tradeoffs in long-term and short-term effectiveness and permanence, cost effectiveness, implementability, reduction in toxicity, mobility, or volume through treatment, State and Community acceptance, and preference for treatment as a principal element.

3) Former Disposal Area/Mounded Area Groundwater: During the public comment period, EPA received numerous comments regarding the extraction and treatment of groundwater at the Former Disposal Area/Mounded Area. As a result, EPA again reviewed the available data regarding the natural attenuation of groundwater at the Former Disposal Area/Mounded Area. Based upon this review, EPA has made a modification from the Proposed Remedy and has selected FDA-G-4. EPA believes that FDA-G-4 provides an equivalent level of protection and long-term effectiveness as the originally proposed remedy, while being more cost effective.

## APPENDIX A - TOXICOLOGICAL PROFILES OF SELECTED SITE CONTAMINANTS

### Carbon Tetrachloride (Tetrachloroethane)

Tetrachloroethane (TCA), more commonly referred to as carbon tetrachloride, is a clear, heavy liquid with a sweet aromatic odor. It is a synthetic chemical with no natural sources. Because it evaporates very easily, it is not usually encountered in its liquid state in the environment. Carbon tetrachloride is readily absorbed from the gastrointestinal tract and more slowly absorbed through the lungs and skin. Most carbon tetrachloride leaves the body by being exhaled through the lungs within a few hours after exposure.

Acute exposures of carbon tetrachloride to humans have shown a wide range of effects. Prior exposure to alcohol, phenobarbital, and some pesticides have been shown to increase the effects of carbon tetrachloride. Single exposures to low concentrations may cause symptoms such as irritation of the eyes, moderate dizziness and headache which disappear once exposure is discontinued. Exposure to higher concentrations will cause the same symptoms as above, but additional symptoms of nausea, loss of appetite, mental confusion, agitation and the feeling of suffocation may be seen. Chronic exposure to carbon tetrachloride produces symptoms of fatigue, lassitude, giddiness, anxiety, headache and muscle twitching. Organ damage is usually restricted to the liver, although there are some reported cases of kidney damage. After chronic exposure there is usually regeneration in these organs. Carbon tetrachloride is carcinogenic in



animals producing mainly liver tumors. The USEPA has classified carbon tetrachloride as a group B2 carcinogen indicating that, based on animal studies, it is probably a human carcinogen, although there are no adequate studies of cancer in humans.

Most carbon tetrachloride is released to the environment in the atmosphere. Although it is moderately soluble in water, its high rate of volatilization results in only about 1% of the total carbon tetrachloride in the environment being in surface waters and oceans. Likewise, carbon tetrachloride tends to volatilize from tap water used for showering, bathing and cooking inside a home (ATSDR, 1989a).

#### 1,1-Dichloroethene (1,1-DCE)

1,1-DCE is used to make certain plastics, such as packaging materials and flexible films like SARAN wrap, and flame-retardant coatings for fiber and carpet backing. It is a clear, colorless liquid and has a mild, sweet smell like chloroform. 1,1-DCE is considered highly volatile and readily migrates to the atmosphere, where it is photo-oxidized by reaction with hydroxyl radicals. It readily volatilizes through the air-filled pores in near-surface soils. Based on a soil sorption coefficient ( $K_{oc}$ ) value of 65, this compound is expected to be only weakly sorbed to soils. This compound is not expected to undergo hydrolysis or microbial degradation in natural systems. In unsaturated near-surface soils, depending on several factors, including percent organic material, about 60 percent of the compound is expected in the gaseous phase, with only 3 percent in the aqueous phase and the remainder absorbed to soil. In deeper soils, 78 percent of the compound is expected to be in the aqueous phase. That portion of the compound that does not volatilize from soil may be expected to be mobile in groundwater.

EPA reports a chronic oral RfD of  $9.0 \times 10^{-3}$  mg/kg-day with the stipulation that the RfD is currently under review (IRIS, 1995). This RfD has an uncertainty factor (UF) of 1000. The confidence in the study, the database, and the RfD is medium. EPA lists the same value for the interim subchronic RfD (HEAST, 1992). No inhalation RfCs are available, however a risk assessment for this compound is under review by an EPA work group (IRIS, 1995).

The oral RfDs were derived from a chronic oral bioassay in which rats were provided drinking water containing either 50, 100, or 200 mg/L 1,1-dichloroethene. The authors calculated intakes to be 7, 10, and 20 mg/kg/day for male rats and 9, 14, and 30 mg/kg/day for female rats (IRIS, 1995). The female rats evidenced hepatic lesions at all exposure levels, while the males only showed a significant effect at 200 mg/L. Therefore, the LOAEL was set at 9 mg/kg-day; a NOAEL could not be determined.

1,1-DCE has been classified by EPA (IRIS, 1995) as a group C (possible human) carcinogen. This classification indicates limited evidence of carcinogenicity in animals with inadequate evidence of human carcinogenicity and is based on the results of tumors observed in one mouse strain following an inhalation exposure to 25 ppm of 1,1-DCE for 5 days/week for 52 weeks (IRIS, 1995). EPA has established an oral CSF of 0.6 (mg/kg/day)<sup>-1</sup> (IRIS, 1995) and an inhalation Carcinogenic Slope Factor (CSF) of 0.18 (mg/kg/day)<sup>-1</sup> (IRIS, 1995). The oral CSF is only valid if the water concentration is below 600 mg/L, and the inhalation CSF is only valid if the air concentration is less than 200 mg/m<sup>-3</sup>.

EPA lists a one-day health advisory of 2 mg/L and a ten-day health advisory of 1 mg/L (Drinking Water Standards and Health Advisories). The ambient water quality criteria for water and fish consumption is  $3.3 \times 10^{-2}$  mg/L and for fish ingestion only is 1.85 mg/L.

EPA (1986) reports an acute concentration of 11,600 mg/L for the dichloroethenes as the LOEC in aquatic systems. 1,1-DCE has a relatively low octanol/water partition coefficient (5.37) and a BCF range from 20 to 30, which indicates that 1,1-DCE may not accumulate significantly in

animals (Lyman et al., 1982). 1,1-DCE is not very toxic to freshwater or saltwater fish species, with acute LC50 values ranging from 80 to 200 mg/L (EPA, 1980).

#### cis-1,2-DCE and trans-1,2-DCE

1,2-DCE exists in two isomeric forms, cis-1,2-DCE and trans-1,2-DCE, that are colorless, volatile liquids with a slightly acrid odor. 1,2-DCE is prepared commercially by either the direct chlorination of acetylene or by the reduction of 1,1,2,2-TCA with fractional distillation used to separate the two isomers. 1,2-DCE can also be formed as a by-product during the manufacture of other chlorinated compounds. Commercial use is not extensive, but trans-1,2-DCE and mixtures of cis- and trans-1,2-DCE have been used as intermediates in the production of other chlorinated solvents and compounds, as well as low temperature extraction solvents for dyes, perfumes, and lacquers. Both cis- and trans-1,2-DCE are moderately flammable and react with alkalis to form chloroacetylene gas, which spontaneously ignites in air.

Information on the toxicity of 1,2-DCE in humans and animals is limited. Workers acutely exposed to 1,2-DCE have been reported to suffer from drowsiness, dizziness, nausea, fatigue and eye irritation. Acute and subchronic oral and inhalation studies of trans-1,2-DCE and acute inhalation studies of cis-1,2-DCE indicate that the liver is the primary target organ in animals; toxicity being expressed by increased activities of liver associated enzymes, fatty degeneration and necrosis. Secondary target organs include the central nervous system and lung. Limited information exists on the absorption, distribution, and excretion of 1,2-DCE in either humans or animals. In vitro studies have shown that the mixed function oxidizes will metabolize 1,2-DCE; the final metabolic products are dependent on the initial isomer of 1,2-DCE.

On the basis of an unpublished study describing decreased hemoglobin and hematocrits in rats treated by gavage for 90 days, EPA (1990a, b) assigned a subchronic and chronic oral RfD for cis-1,2-DCE of 1E-1 mg/kg/day and 1E-2 mg/kg/day, respectively. The RfDs were derived from a NOAEL Lowest Observed Adverse Affect Level (LOAEL) of 32 mg/kg/day. An inhalation RfC for cis-1,2-DCE has not been derived.

Subchronic and chronic RfDs of 2E-1 mg/kg/day and 2E-2 mg/kg/day, respectively, for trans-1,2-DCE have been calculated. The RfDs were derived from a LOAEL of 175 mg/kg/day based on the increase of serum alkaline phosphatase activity in mice that received trans-1,2-DCE in their drinking water. An RfC for trans-1,2-DCE has not been derived.

No information was available concerning the chronic, developmental or reproductive toxicity of cis-1,2-DCE or trans-1,2-DCE. No cancer bioassays or epidemiological studies were available to assess the carcinogenicity of 1,2-DCE. EPA has placed cis-1,2-DCE in weight-of-evidence Group D (not classifiable as to human carcinogenicity) based on the lack of human or animal carcinogenicity data and on essentially negative mutagenicity data. Trans-1,2-DCE has not been classified.

Because of its volatility, the primary route of 1,2-DCE exposure to humans is by inhalation, although dermal and oral exposure can occur. Exposure to 1,2-DCE may occur as a result of releases from production and use facilities, from contaminated waste disposal sites and wastewater, and from the burning of polyvinyl and vinyl copolymers. 1,2-DCE contaminates groundwater supplies by leaching from waste disposal sites. Therefore, human oral, dermal, and inhalation exposure can occur from drinking and using water, and by breathing vapors from 1,2-DCE-contaminated supplies and delivery systems.

#### Tetrachloroethene (PCE)

PCE is a halogenated aliphatic hydrocarbon. It is a colorless liquid with a molecular weight of

165.85 and a vapor pressure of 17.8 mm Hg at 25°C. PCE has a half-life of 47 days in the atmosphere and 30 to 300 days in surface water and groundwater. PCE is used primarily as an industrial solvent for a number of applications, and is routinely used in laundry and dry cleaning operations. Inhalation exposure is the primary concern for workers. The general public can also be exposed to PCE by inhalation, mainly in areas of concentrated industry and population. Some of the highest outdoor air levels (up to 58,000 ppt) have been associated with waste disposal sites. Exposure can also occur through contact with contaminated food and water supplies. An estimated 7 to 25 percent of the water supply sources in the United States may be contaminated with PCE.

The main targets of PCE toxicity are the liver and kidneys by both oral and inhalation exposure, and the central nervous system (CNS) by inhalation exposure. Acute exposure to high concentrations of the chemical (estimated to be greater than 1500 ppm for a 30-minute exposure) may be fatal. Chronic exposure causes respiratory tract irritation, headache, nausea, sleeplessness, abdominal pains, constipation, cirrhosis of the liver, hepatitis, and nephritis in humans; and microscopic changes in renal tubular cells, squamous metaplasia of the nasal epithelium, necrosis of the liver, and congestion of the lungs in animals.

RfDs for chronic and subchronic oral exposure to PCE are 0.1 mg/kg/day and 0.01 mg/kg/day, respectively (Buben and Flaherty, 1985; USEPA, 1990; 1991). These values are based on hepatotoxicity observed in mice given 100 mg PCE/kg body weight for 6 weeks and a NOAEL of 20 mg/kg.

Epidemiological studies of dry cleaning and laundry workers have demonstrated excesses in mortality due to various types of cancer, including liver cancer, but the data are regarded as inconclusive because of various confounding factors. The tenuous finding of an excess of liver tumors in humans is strengthened by the results of carcinogenicity bioassays in which PCE, administered either orally or by inhalation, induced hepatocellular tumors in mice. PCE was negative for tumor initiation in a dermal study and for tumor induction in a pulmonary tumor assay.

Based on the sufficient evidence from oral and inhalation studies for carcinogenicity in animals and no or inadequate evidence for carcinogenicity to humans, PCE is placed in EPA's weight-of-evidence Group B2 (probable human carcinogen). For oral exposure, the slope factor is  $5.1 \times 10^{-2}$  (mg/kg/day)<sup>-1</sup> the unit risk is  $1.5 \times 10^{-6}$  (mg/L)<sup>-1</sup>. For inhalation exposure, the slope factor was calculated as  $2.03 \times 10^{-3}$  from the unit risk of  $5.2 \times 10^{-7}$  (mg/m<sup>3</sup>)<sup>-1</sup>.

#### Trichloroethene (TCE)

TCE is a colorless, stable liquid with a chloroform like odor. It has a molecular weight of 131.5, a vapor pressure of 60mm Hg at 20°C, and a solubility of 1,100 mg/l at 25°C. TCE is considered slightly soluble in water and is miscible with common organic solvents. TCE is used as a metal degreaser, as an extraction solvent for oils, fats, and waxes, for solvent dyeing, in dry cleaning, and for cleaning and drying electronic parts.

Inhalation exposure is the most likely route for human-contact with TCE. Systemic health effects have generally been reported only when people are exposed to TCE levels above the odor threshold. There are a few case reports of humans exhibiting kidney and liver damage following exposure to very large amounts of TCE.

There is no reliable information concerning the adverse systemic effects of chronic exposure to levels of TCE below the threshold limit value of 50 ppm. Neurological effects reported in workers exposed for less than 15 years to relatively high mean TCE levels (167 ppm) include vertigo, fatigue, headache, and short-term memory loss. The number of symptoms increased

with cumulative exposure time.

EPA's IRIS database currently does not list a chronic oral or inhalation RfD for TCE. The chronic systemic toxicity of TCE is currently under review by the RfD Workgroup. Pending this review, a provisional chronic oral RfD of  $6 \times 10^{-3}$  mg/kg-day was issued by ECAO (now NCEA) in 1992, based on the subchronic mouse study by Tucker, et al (1982). The critical effect seen in this study was liver toxicity following oral administration.

Animal studies have shown increases in cancers of various types following inhalation or oral exposure to TCE. These cancer types include cancer of the liver and forestomach in mice, and cancer of the kidney and testes in rats. It is believed that tumor production by TCE is the result of metabolites of TCE. There are differences between high- and low-dose metabolism of TCE, as well as differences between species' susceptibility to cancer. Given that enormous worker populations have been exposed to TCE, and that only a small number of persons have experienced chronic effects, it is possible that TCE is not metabolized to the active carcinogen level in humans at low environmental doses. The mechanisms of carcinogenicity are not known. EPA has classified TCE as a Class B2 (adequate evidence in animals but insufficient evidence in humans) carcinogen.

Mutagenesis studies have suggested that TCE is only very weakly genotoxic following metabolic activation. The Health Assessment Document concludes that there is insufficient evidence to prove that TCE is mutagenic.

#### 1,1,2-Trichloroethane (1,1,2-TCA)

1,1,2-TCA is a colorless, sweet-smelling liquid that does not burn easily and boils at a higher temperature than water. It is used mostly where 1,1-DCE (vinylidene chloride) is made. 1,1,2-Trichloroethane is used as a solvent. 1,1,2-TCA can enter the body when a person inhales air containing the compound, or when a person drinks water containing this compound. It can also enter the body through the skin. After it enters the body, it is carried by the blood to organs and tissues such as the liver, kidney, brain, heart, spleen, and adipose (fat) tissue. Experiments in which animals were given 1,1,2-TCA by mouth have shown that most of the compound leaves the body unchanged in the breath and as other metabolites in the urine in approximately one day. Very little 1,1,2-TCA stays in the body for more than two days.

1,1,2-TCA can cause temporary stinging and burning pain on the skin. There is no other information on the health effects of 1,1,2-TCA in humans. Short-term exposure to high levels in the air or high doses given by mouth or applied to the skin has caused death in animals. Long-term exposure of animals to high doses given by mouth has also shortened the lifespan. Breathing high levels in air can affect the nervous system and cause sleepiness. 1,1,2-TCA may also affect the liver, kidney, and digestive tract, produce skin irritation, and affect the immune system. Mice, but not rats, that were given high doses of 1,1,2-TCA by mouth for most of their life developed liver cancer, but we do not know whether humans exposed to this chemical would develop cancer (ATSDR, 1989b). The U.S. EPA has classified 1,1,2-TCA as a group, possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data).

In wastewater treatment plants that receive refractory volatile compounds, such as 1,1,2-TCA, from industrial discharges or other sources, stripping will be an important mechanism for transferring the chemical from the water into the air. 1,1,2-TCA will not adsorb appreciably to soil, sediment, and suspended solids in the water column and would be expected to readily leach into the subsurface soil and ground water. The bioconcentration factors for 1,1,2-TCA are low; therefore, it would not be expected to bioconcentrate in fish to any great extent (ATSDR, 1989b).

## Lead

Lead is a commonly used, naturally occurring metal which is ubiquitous in the environment. Lead is found in construction materials, leaded gasoline, radiation protection gear, paint, ceramics, plastics, and ammunition. Lead is well absorbed from the respiratory tract, including the nasal passages. Absorption from the gastrointestinal tract is less rapid and complete than from the respiratory tract. Dermal absorption is a much less significant route of exposure than inhalation or ingestion. Absorbed lead is distributed to the soft tissues of the body with the greatest distribution to the kidneys and the liver. Lead is eventually transferred to the skeleton where 90% of the body's long-term burden is stored. The portion of lead that is not absorbed is excreted in the feces. Most of the absorbed lead is excreted in the urine or through biliary clearance into the gastrointestinal tract (ATSDR, 1988).

Lead intoxication in humans can occur by ingestion and inhalation of dust or fumes. Symptoms of lead intoxication include anorexia, malaise, headaches and intestinal spasms. The neuromuscular disease, lead palsy, is a result of advanced subacute poisoning (lead blood levels of 70 Ig/dL and less), and is characterized by muscle weakness leading to paralysis. Lead encephalopathy is the term used for the central nervous system manifestation which is commonly seen in children when lead blood levels reach 90 Ig/dL. Symptoms include clumsiness, dizziness, delirium, convulsions and coma. The mortality rate is 25% when the brain is involved, with survivors suffering long-term neurological problems (ATSDR, 1988; HSDB, 1988; IRIS, 1994; USDHHS, 1991).

Chronic low level lead exposure (lead blood levels of 30-50 Ig/dL) is associated with learning disabilities. Lead toxicity is defined by the Centers for Disease Control as a blood level of 25 Ig/dL or greater in a child. Damage at lower levels has been reported and the blood level will be revised to approximately 10-15 Ig/dL. Kidney damage occurs after prolonged exposure, and is apparently reversible. In epidemiological studies, lead intoxication is also associated with increased blood pressure which is symptomatic of kidney damage. Lead exposure is associated with reproductive effects such as miscarriages and temporary sterility. Lead readily crosses the placenta. Occupational exposure to airborne lead is associated with an increased incidence of total malignant neoplasms, cancers of the digestive tract and cancers of the respiratory tract. An increased incidence in kidney cancer was seen in lead smelter workers exposed by inhalation and in various animal species exposed by ingestion at levels of 500 ppm and above. The USEPA has classified lead as a group B2 carcinogen based on animal studies (probable human carcinogen with inadequate or no evidence in humans) (ATSDR, 1988; HSDB, 1988; IRIS, 1994; USDHHS, 1991).

The mobility of lead in soil is dependent on the chemical properties of the soil. Lead can react with sulfates, carbonates and phosphates or combine with clays and organic matter which limits the further migration of lead through the soil matrix. Lead in surface waters is usually present as suspended solids. Atmospheric lead is removed by dry deposition and rainout. Lead does not significantly bioaccumulate in fish. Lead localizes in fish skin which serves to reduce human exposures by fish consumption. Lead is toxic to wildlife, particularly water fowl, through their consumption of lead shot. Tetraethyl lead is biodegradable, but inorganic lead concentrations above 5 Ig/L can be toxic to microorganisms. As water hardness increases, the acute toxicity of lead to freshwater aquatic species decreases (ATSDR, 1988; HSDB, 1988; IRIS, 1994; USDHHS, 1991).

## APPENDIX B - FIGURES

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## APPENDIX C - TABLES

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Table 6  
TCE-Related Compounds for Soil Gas Samples

EPA Method Modified 8240  
1,2-Dichlorethane  
1,1-Dichlorethane  
trans-1,2-Dichloroethene  
cis-1,2-Dichloroethene  
1,1-Dichloroethene  
Tetrachloroethene  
1,1,1-Trichloroethane  
Trichloroethene



Table 7  
Chemicals of Potential Concern for Human Health Evaluation  
Malvern TCE  
Soil

Surface Soil		Subsurface Soil
UST Area	FDA Excavated Area	UST Area
Bis(2-ethyl hexyl)phthalate	Aluminum	Tetrachloroethene
Arsenic	Arsenic	Trichloroethene
Beryllium	Beryllium	Arsenic
Iron	Cadmium	Iron
Manganese	Chromium	Manganese
	Iron	
	Thallium	SE of Distillation Building
		Arsenic
SE of Distillation Building	Area South of Garage	Iron
Arsenic	None	Manganese
Beryllium		
Chromium	FDA Mounded Area	AST Area
Iron	Benzo(a)pyrene	Iron
Manganese	Aluminum	Manganese
Thallium	Beryllium	
	Cadmium	FDA Mounded Area
AST Area	Iron	1,2-Dichloroethene (total)
Benzo(b)fluoranthene	Manganese	Tetrachloroethene
Benzo(a)pyrene	Thallium	Trichloroethene
Aluminum		Arsenic
Beryllium		Iron
Iron		Manganese
Manganese		

Groundwater (Offsite Residential Wells)

Current Scenario	Future Scenario	
Well DW-02	DW-036	DW-041 (continued)
Chloroform	Chloroform	cis-1,2-Dichloroethene
	1,1-Dichloroethene	Tetrachloroethene
DW-07	cis-1,2-Dichloroethene	1,1,1-Trichloroethane
Chloroform	Tetrachloroethene	Trichloroethene
	1,1,2-Trichloroethane	
DW-46	Trichloroethene	DW-068
1,1-Dichloroethene		cis-1,2-Dichloroethene
	DW-041	Tetrachloroethene
DW-66	Chloroform	Trichloroethene
1,1-Dichloroethene	1,1-Dichloroethene	

Groundwater (Industrial - monitoring wells) a

Former Disposal Area	Main Plant Area	
Carbon Tetrachloride	Carbon Tetrachloride	Aluminum
Chloroform	Chloroform	Antimony
1,2-Dichloroethane	1,1-Dichloroethane	Arsenic
1,1-Dichloroethene	1,2-Dichloroethane	Barium
cis-1,2-Dichloroethene	1,1-Dichloroethene	Beryllium
Tetrachloroethene	cis-1,2-Dichloroethene	Cadmium

1,1,1-Trichloroethane	Tetrachloroethene	Chromium
Trichloroethene	1,1,2,2-Tetrachloroethane	Iron
Vinyl Chloride	1,1,1-Trichloroethane	Manganese
	1,1,2-Trichloroethane	Nickel
	Trichloroethene	Thallium
	Vinyl Chloride	Vanadium
	Naphthalene	

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TABLE 12 - SUMMARY OF ALTERNATIVES

Water Supply

WS-G-3a: Public Water Supply  
 WS-G-3b: Well Head Treatment

Main Plant Area Soils

MPA S-1: No Action  
 MPA S-2: Institutional Controls  
 MPA S-3: Capping  
 MPA S-4: InSitu Soil Vapor Extraction

Main Plant Area Groundwater

MPA-G-1: No Action  
 MPA-G-2: Institutional Controls  
 MPA-G-4: Natural Attenuation  
 MPA-G-5: Groundwater Collection, Treatment & Discharge  
 MPA-G-6: Groundwater Collection, Treatment of Source Area & Discharge

Former Disposal Area Soils

FDA-S-1: No Action  
 FDA-S-2: Institutional Controls  
 FDA-S-3: Capping  
 FDA-S-4: Excavation, Off-Site Thermal Treatment, Disposal at a Subtitle C Landfill  
 FDA-S-5: Excavation, ExSitu Volatilization, & Reuse as Backfill  
 FDA-S-6: Excavation, On-Site Thermal Treatment, and Reuse as Backfill  
 FDA-S-7: InSitu Soil Vapor Extraction  
 FDA-S-8: Excavation, Consolidation of Soils at the Main Plant

Former Disposal Area Groundwater

FDA-G-1: No Action  
 FDA-G-2: Institutional Controls  
 FDA-G-4: Natural Attenuation  
 FDA-G-5: Groundwater Collection, Treatment, and Discharge  
 FDA-G-6: Groundwater Collection, Treatment (Single Well), and Discharge

Table 13  
Malvern TCE Site - Identification of ARARs  
Water Supply Remedy

Requirement	Type	Citation
The water supply provided shall achieve MCLs	Chemical	The Safe Drinking Water Act 42 U.S.C. ºº 300(f)-300(j), and 40 CFR º141
The installation of the water line shall avoid, minimize and mitigate impacts on floodplains and wetlands.	Location	Executive Order No. 11989 and 40 CFR Part 6, Appendix A (regarding avoidance, minimization, and mitigation of impacts on floodplains) and Executive Order No. 11990 and 40 CFR Pad 6, Appendix A (regarding avoidance, minimization, and mitigation of wetlands
Existing Residential wells shall be abandoned	Action	Pennsylvania Safe Drinking Water Act, 25 Pa Code Section 109.62 and consistent with PADEPs Public Water Supply Manual, part 11, Section 3.3.5.11 and Chester County Health Department Rules and Regulations Chapter 500.
Management of the spent carbon filters shall be in accordance with the substantive requirements of hazardous waste regulations.	Action	25 Pa. Code Chapter 262 Subparts A (relating to hazardous waste determination and identification numbers), B (relating to manifesting requirements for off-site shipments of spent carbon or other hazardous waste); and C (relating to pretransport requirements); 25 Pa. Code Chapter 264, Subparts B-D,1 (in the event that hazardous waste is managed, treated, or stored in tanks), and 40 CFR 268 Subpart C, Section 268.30, and Subpart E (regarding prohibitions on storage of hazardous waste).

Table 13  
Malvern TCE Site - Identification of ARARs  
Main Plant Area Soils Remedy

Fugitive dust emissions generated during remedial activities will be controlled	Action	Fugitive dust regulations in the federally approved State Implementation Plan (SIP) for the Commonwealth of Pennsylvania, 25 PA Code §§ 123.1 - 123.2, and the National Ambient Air Quality Standards for Particulate matter 40 CFR §§ 50.6 and PA Code §§ 131.2 and 131.3
Quonset Hut debris shall be decontaminated in accordance with the Hazardous Debris Rule and properly disposed or reused.	Action	Hazardous Debris Rule 40 CFR 268.45
USTs shall be decontaminated in accordance with the Hazardous Debris Rule and properly disposed or reused.	Action	Hazardous Debris Rule 40 CFR 268.45
The Main Building (including Loading Dock and Chemical Laboratory) shall be closed in accordance with Federal and PA Hazardous Waste Regulations.	Action	25 Pa Code § 265.110 through 265.119, 265.442(7); 40 C.F.R. §§ 264.110 through 264.120, 264.178, 270.14(b)(13)
Wastewater generated during decontamination activities shall be properly managed.	Action	PA Hazardous Waste Regulation

Table 13  
Malvern TCE Site Identification of ARARs  
Main Plant Area Groundwater Remedy

Requirements	Type	Citation
Any new wells installed must be drilled in accordance with Pennsylvania Water Well Drillers regulations	Action	25 Pa Code Chapter 107. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S.º 645.1 et seq.
The treated groundwater effluent shall be reinjected in accordance OSWER Directive #9234.1-06.	Action	"Applicability of Land Disposal Restrictions to RCRA and CERCLA Groundwater Treatment Reinjection", OSWER Directive #9234.1-06.
The installation of the extraction and treatment system shall avoid, minimize and mitigate impacts to wetlands.	Location	Executive Order No. 11998 and 40 CFR Part 6, Appendix A (regarding avoidance, minimization and mitigation of impacts on floodplains) and Executive Order No. 11990 and 40 CFR Part 6, A (regarding avoidance, minimization and mitigation of impacts on floodplains) and Executive Order No. 11990 and 40 CFR Part 6, Appendix A (regarding avoidance, minimization, and mitigation of wetlands
Existing pumping and/or monitoring wells which serve no useful purpose shall be properly plugged and abandoned.	Action	PADEP's Public Water Supply Manual, Part 11, Section 3.3.5.11 and Chester County Health Department Rules and Regulations Chapter 500, in order to eliminate the possibility of these wells acting as a conduit for future groundwater contamination.
Air Emissions from Superfund Site shall be controlled.	To Be Considered	OWSER Directive #9335.0-28, Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites.
Air Emissions will also comply State and Federal Requirements	Action	40 CFR ºº 264.1030 - 264.1063 (Air Emissions Standards for Equipment Leaks). Air emissions of Vinyl Chloride will comply with 40 CFR Parts 61.60 - 61.69, National Emission Standards for Hazardous Air Pollutants (NESHAPS.). 42 U.S.C ºº7401 et seq. are applicable and must be met for the discharge of contaminants to the air. Air permitting and emissions ARARs are outlined in 25 PA Code ºº 121.1 - 121.3, 121.7, 123.1, 123.2, 123.31, 123.41, 127.1, 127.11, 127.12 and 131.1 - 131.4. 25 PA Code º 127.12 requires all new air emission sources to achieve minimum attainable emissions using the best available technology ("BAT"). In addition, the PADEP air permitting guidelines for remediation projects require all air striping and vapor extraction units to include emission control equipment.

Table 13  
Malvern TCE Site Identification of ARARs  
Main Plant Area Groundwater Remedy

Management of the spent carbon filters shall be in accordance with the substantive requirements of hazardous waste regulations.	Action	25 Pa. Code Chapter 262 Subparts A (relating to hazardous waste determination and identification numbers), B relating to manifesting requirements for off site shipments of spent carbon or other hazardous wastes); and with respect to the operations at eh the Site generally, with the substantive requirements of 25 Pa Code Chapter 264, Subparts B-D, 1 (in the event that hazardous water generated as part of the remedy is managed in containers), 25 Pa. Code Chapter 264, Subpart J (in the event that hazardous waste is managed in containers), 25 Pa. Code Chapter 264, Subpart C, Section 268.30 and Supart E (regarding prohibitions on storage of hazardous waste).
Fugitive dust emissions generated during remedial activities will be controlled in order to comply with federal and state air regulations.	Action	Fugitive dust regulations in the federally-approved State Implementation Plan (SIP) for the Commonweallh of Pennsylvania, 25 PA Code °° 123.1 - 123.2 and the national Ambient Air Quality Standards for Particulate Matter 40 CRF °° 50.6 and PA Code °° 131.2 and 131.3
Extraction and Discharge of groundwater shall be in accordance with the substantive requirements of the Delaware River Basin Commission	Location	(18 CFR Part 430) we applicable; These regulations establish requirements for the extraction and discharge of ground water within the Delaware River Basin.
The groundwater shall be restored to MCLs	Chemcial	The Safe Drinking Water Act 42 U.S.C °° 300(f)-300(j), and 40 CFR ° 141

Table 13  
Malvern TCE Site Identification of ARARs  
Former Disposal Area/Mounded Area (FDA/MA) Soils Remedy

Requirements	Type	Citation
Any on-site landscaping will be in accordance with Federal Landscaping guidance.	To Be Considered	Office of the Federal Executive; Guidance for Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal landscaped Grounds, 60 Fed Reg 40837 (August 10, 1995) which is a "to be considered" (TBC) requirement
RCRA listed constituents are present in the soils, therefore, the remedy will be implemented consistent with the following substantive requirements, which are applicable to on-site activities.	Action	Pa. Code ¨ 262.11 - 262.13 (relating to pretransport requirements); 25 Pa. Code ¨ 262.34 (relating to pretransport requirements), 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements f 25 Pa. Code Chapter 264, Subparts B-D, 1 (in the event that hazardous waste generated as part of the remedy).
Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather consistent with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual.	To Be considered	PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual
Fugitive dust emissions generated during remedial activities will be controlled in order to comply with federal and state air regulations.	Action	Fugitive dust regulations in the federally-approved State Implementation Plan (SIP) for the Commonwealth of Pennsylvania, 25 PA Code ¨ 123.1 - 123.2 and the National Ambient Air Quality Standards for Particulate matter in 40 CFR ¨ 50.6



Table 13  
FDA/MA Groundwater Remedy  
ARARs

Requirements	Type	Citation
Installation of additional wells may be necessary and must be in accordance Water Well Drillers License Act.	Action	25 Pa. Code Chapter 107. These regulations are established pursuant to the Water well Drillers License Act, 32 P.S. � 645.1 et seq.
The groundwater shall be restored to MCLs.	Chemical	The Safe Drinking Water Act 42 U.S.C �� 300(f)-300(j), and 40 CFR �141.

TABLE 14  
MALVERN TCE SUPERFUND SITE

RESIDENTIAL WELLS TO HOOK UP TO PUBLIC WATER

Well Number	Address
3	11 Hillbrook Circle
4	25 Hillbrook Circle
7	36 Hillbrook Circle
20	232 N. Phoenixville Pike
42	13 Hillbrook Circle
43	21 Hillbook Circle
53	29 Hillbrook Circle
54	28 Hillbrook Circle
60	39 Hillbrook Circle
66	215 N. Phoenixville Pike
1	8 Hillbrook Circle
2	4 Hillbrook Circle
5	26 Hillbrook Circle
12	365 Conestoga Rd
30	330 Conestoga Rd
31	405 Conestoga Rd
32	411 Conestoga Rd
45	9 Hillbrook Circle
46	7 Hillbrook Circle
47	5 Hillbrook Circle
48	1 Hillbrook Circle
49	2 Hillbrook Circle
51	10 Hillbrook Circle
61	38 Hillbrook Circle
62	388 Conestoga Rd
63	386 Conestoga Rd
64	384 Conestoga Rd
69	3 Hillbrook Circle
70	211 N. Phoenixville Pike
71	409 Conestoga Rd
100	366 Conestoga Rd
200	407 Conestoga Rd
6	32 Hillbrook Circle
9	33 Hillbrook Circle

10	256 N. Phoenixville Pike
15	208 N. Phoenixville Pike
16	212 N. Phoenixville Pike
19	228 N. Phoenixville Pike
23	244 N. Phoenixville Pike
33	15 Millbrook Circle
36	17 Millbrook Circle
41	19 Millbrook Circle
44	23 Millbrook Circle
50A	6 Millbrook Circle
52A	27 Millbrook Circle
55A	30 Millbrook Circle
56	31 Millbrook Circle
57	34 Millbrook Circle
58A	35 Millbrook Circle
59A	37 Millbrook Circle
65	248 N. Phoenixville Pike
67	410 Conestoga Rd

RESPONSIVENESS SUMMARY  
FOR THE  
PROPOSED REMEDIAL ACTION PLAN  
FOR THE  
MALVERN TCE SUPERFUND SITE  
EAST WHITELAND TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

Public Comment Period  
June 23, 1997, through September 2, 1997

Malvern TCE Superfund Site

Responsiveness Summary  
for the  
Proposed Remedial Action Plan

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Responsiveness Summary  
Malvern TCE Superfund Site  
East Whiteland Township, Chester County, Pennsylvania

This Responsiveness Summary is divided into the following sections:

Overview

The overview summarizes the public's response to remedial(cleanup) alternatives listed in the Proposed Remedial Action Plan ("Proposed Plan"). The Proposed Plan outlined various methods of cleanup of the Malvern TCE Site and discusses EPA's preferred method.

Background

This section provides a brief history of community relations activities conducted during remedial planning at the Malvern TCE Superfund Site.

I. Summary of Major Comments and Questions Received During the Public Meeting and EPA Responses

This section documents comments and questions from citizens and potentially responsible parties during the July 16, 1997 Public Meeting at Great Valley High School in Malvern, PA. These comments and questions and EPA's responses are categorized by topic.

II. Summary of Major Comments and Questions Received During the Public Comment Period in Writing and EPA Responses

This section provides a comprehensive response to all significant comments received in writing by EPA during the Public Comment period.

Overview

The Proposed Plan for the Malvern TCE Site (Site), located in East Whiteland Township, Chester County, Pennsylvania was issued on June 23, 1997. EPA's public comment period for the Site was originally scheduled to run from June 23, 1997 through July 23, 1997. This comment period was extended until September 2, 1997 in response to several timely requests. EPA conducted a public meeting on July 16, 1997 to present the Proposed Plan to the public. At this meeting, the public was given an opportunity to ask questions and to comment on the cleanup alternatives outlined in the Proposed Plan and the results of the Remedial Investigation (RI) for the Site. The Proposed Plan details EPA's preferred clean-up alternatives to cleanup the Site contamination, giving consideration to the following nine evaluation criteria:

Threshold Criteria

- D Overall protection of human health and the environment
- D Compliance with Federal, state, and local environmental and health laws

Balancing Criteria

- D Long-term effectiveness and permanence
- D Reduction of mobility, toxicity, or volume of contaminants
- D Short-term effectiveness
- D Ability to implement

**D** Cost

Modifying Criteria

**D** State acceptance

**D** Community acceptance

EPA carefully considered state and community acceptance of the clean-up alternatives before reaching the final decision regarding the clean-up plan. The Record of Decision (ROD) details EPA's final clean-up decision.

EPA's selected remedy is outlined below. These alternatives provide the best balance among the alternatives with respect to the nine evaluation criteria EPA used to evaluate each alternative.

Water Supply: To prevent contact with groundwater contamination at residences affected or potentially affected by the Site, EPA has selected Alternative WS-G-3a, Public Water Supply.

Main Plant Area Soils: To prevent direct contact with contaminated soils in the Main Plant Area and to reduce the potential for continued migration of these contaminants to the groundwater, EPA has selected Alternative MPA-S-3, Capping.

Main Plant Area Groundwater: To reduce the migration of contaminated groundwater from the Main Plant Area, EPA has selected Alternative MPA-G-6, Groundwater Collection, Treatment of Source Area, and Discharge by Reinjection.

**D** Former Disposal Area/Mounded Area Soils: To reduce the potential for continued migration of contaminants in these soils to the groundwater, EPA has selected Alternative, FDA-S-4, Excavation, Off-Site Thermal Treatment, Disposal at a Hazardous Waste Facility.

**D** Former Disposal Area/Mounded Area Groundwater: To reduce concentrations of contaminants in groundwater to MCLs, EPA has selected FDA-G4, Natural Attenuation .

Background

Historically, public concern and involvement with the Malvern TCE Superfund Site has been moderate. In the early 1980s, residents became familiar with the Site when the Pennsylvania Department of Environmental Protection (PADEP) discovered soil and groundwater contamination on the property and groundwater contamination in nearby residential water wells.

From 1982 through 1992, residents on Phoenixville Pike and in the Hillbrook Circle development were involved with the Site while Chemclene, the Site's owner and a potentially responsible party (PRP), periodically tested residential water wells and placed carbon filters on wells with trichloroethene (TCE) contamination. Some residents only became aware of the Site and its associated contamination when their wells ran dry and they were required to redrill. According to residents, EPA's RI and community relations activities have increased the community's awareness and understanding of the Site.

EPA began considering the Site under the Superfund remedial program in November 1993. EPA first initiated community relations activities in July 1995. During that month EPA established an information repository at the Chester County Library, issued a fact sheet, and held a public meeting.

EPA's fact sheet provided a brief history of the Malvern Site, an overview of EPA's activities at the Site, and a description of the Site contamination. The fact sheet also announced EPA's first public informational session which was held on July 31, 1995. The purpose of the information session was to inform residents of the contamination at the Site and the status of EPA's activities at the Site. The East Whiteland Township Environmental Advisory Board hosted the meeting and approximately 20 people attended.

In October 1995, EPA issued a second fact sheet which provided background information on the Site and the status of the groundwater and soil investigations and residential well sampling.

In February and March 1996, EPA conducted community interviews with residents living in the Hillbrook Circle and Aston Woods residential developments. These interviews allowed EPA to speak with residents one-on-one about their concerns and questions regarding the Malvern Site.

In March 1996, EPA issued another fact sheet. This fact sheet announced approval of the sampling plan for the Site, discussed the scheduled soil sampling and its potential impact on the community, announced the preparation of the Community Relations Plan (CRP) for the Malvern Site, and announced the schedule of residential water sampling.

On April 25, 1996, EPA held an information session at the Great Valley High School to respond to concerns and questions residents had raised during the community interviews. EPA officials who attended the meeting included: Linda Dietz, Remedial Project Manager; Jennifer Hubbard, toxicologist; Barbara Rudnick, hydrogeologist; and Carolyn Szumal, Community Involvement Coordinator. In addition, Ron Sloto, a hydrogeologist with the U.S. Geological Survey attended. EPA sent postcards to local residents to invite them to the information session.

EPA issued the CRP for the Malvern Site in May 1996. The CRP highlighted issues, concerns, and interests of the community located near the Site and provided background information about the Superfund process and the Site. In addition, the CRP listed EPA's community relations objectives and planned activities intended to encourage public participation in Site activities.

To announce the availability of and to obtain public input on the Proposed Remedial Action Plan (Proposed Plan), EPA held a public comment period from June 23, 1997, through September 2, 1997. During the public comment period, EPA issued a fact sheet and held a public meeting in the Great Valley High School Auditorium on July 16, 1997, to provide residents with information about the Site and the proposed clean-up alternatives. The public meeting also provided an opportunity for residents to ask questions about or comment on the Site and EPA's proposed clean-up alternatives. EPA announced the public meeting, the opening of the public comment period, and the availability of the Proposed Plan in a public notice placed in the Daily Local News on June 23, 1997.

The July 1997 fact sheet highlighted EPA's preferred alternatives to cleanup the contamination at the Site, announced the availability of the Remedial investigation/Feasibility Study (RI/FS) and Proposed Plan in the information repository, provided a brief history of the Site, invited the public to comment on the documents in the information repository, and announced the public meeting.

To announce the extension of the public comment period to September 2, 1997, EPA placed a public notice in the Daily Local News on July 28, 1997.

Part I: Summary of Commentors' Major Issues and Concerns During the Public Meeting

This section provides a summary of commentors' major issues and concerns and EPA's responses to those issues and concerns. "Commentors" may include local homeowners, businesses, the municipality, and PRPs. The major issues and concerns about the proposed clean-up alternatives for the Malvern Site received during the public meeting on July 16, 1997, and during the public comment period, are grouped into the following categories:

- A. Operations at the Site
- B. The Preferred Soil Alternatives
- C. The Preferred groundwater Alternatives
- D. The Preferred Water Supply Alternative
- E. Bioremediation
- F. Responsibilities of the PRPs
- G. The Time Frame for the Remedial Action
- H. The Site's Impact on the Surrounding Community
- I. The Contamination

A. Operations at the Site

1. Why didn't EPA or PADEP take action against Chemclene for so many years even though both agencies knew there were problems in 1980?

EPA Response: During the early 1980s, Chemclene assumed responsibility for investigating and cleaning up the contamination at the Site. Chemclene provided carbon filters for the affected residents, performed drum removal activities at the Former Disposal Area and removed contaminated soil at the Former Disposal Area. The majority of this work was performed with the oversight of Pennsylvania Department of Environmental Resources. In 1987, EPA took an administrative enforcement action pursuant to the Resource Conservation and Recovery Act (RCRA) against Chemclene and entered into a Corrective Action Order with Chemclene. The Corrective Action Order required Chemclene to investigate and remediate contamination at the Site. Chemclene failed to implement the requirements of the RCRA Corrective Action Order and began considering the Site under the Superfund remedial program in November 1993.

2. Several commentors expressed their disapproval that Chemclene was allowed to operate for so many years even though Chemclene mishandled chemicals, creating a hazard for area residents. The commentors felt that Chemclene should not be permitted to stay in business.

EPA Response: See Response to Part I, A. #7 and Part II, E. #1.

3. A representative from one of the PRPs inquired how his company could be sure that something like this would not happen to him again (i.e. be named a PRP at other sites). How could he find out if the vendor to which his company currently transports waste was doing the same things as Chemclene did?

EPA Response: EPA encourages companies to minimize their waste stream instead of creating waste that needs to be disposed of in some manner, and to examine their processes for opportunities to eliminate the creation of waste in the first place. If waste is created, however, to inquire about a disposal or treatment company's environmental record, the public can call the state environmental agency or the appropriate EPA Region to find out what permit(s) the company holds and if that company has been found to be in violation of any environmental regulations. PADEP regularly inspects all companies permitted to accept hazardous waste in Pennsylvania. EPA information is available to the public under the Freedom of Information Act.



4. Who currently regulates Chemclene's operations at the Site?

EPA Response: Chemclene Corporation does not have a hazardous waste treatment, storage, or disposal permit. The current operation is regulated by the East Whiteland Township, Office of the Fire Marshall. Chemclene Corporation holds a Hazardous Operations Permit with the Office of the Fire Marshall and is permitted to store combustible liquids and oxidizers at the facility. The storage of certain amounts of chemicals is subject to the federal Emergency Planning and Community Right to Know Act.

5. Who sets the standards and regulations which the East Whiteland Township Fire Marshall must enforce when regulating Chemclene - EPA, PADEP, or East Whiteland Township?

EPA Response: The Fire Marshall regulates Chemclene Corporation in accordance with the Fire Prevention Code of East Whiteland Township. The Fire Prevention Code is adopted by the East Whiteland Township, Board of Supervisors. During the public meeting a reference was made to the BOCA codes but this was incorrect.

6. What or who occupied the Site before Chemclene started a business there?

EPA Response: According to aerial photography, prior to the beginning of Chemclene's operation in 1952, the area was forested.

7. Why was there no enforcement action taken against Chemclene for so many years and why didn't EPA notify or warn other companies that dealt with Chemclene that there were problems at the facility? Chemclene had all the required EPA licenses.

EPA Response: EPA generally does not warn other companies of environmental problems. Generally, it is up to the generator to ensure the facility they choose for disposal is in compliance. See Response #1 above and Response in Part II, Section E.1 on page 37.

8. When was Chemclene's hazardous waste permit revoked?

EPA Response: Chemclene withdrew its hazardous waste permit (Part B permit) in July 1992. This response is corrected from that given at the public meeting where it was stated that Chemclene's hazardous waste operations ended in mid-1993.

B. The Preferred Soil Alternatives

1. If EPA excavated the soil from the Former Disposal Area and transported it to the Main Plant Area, what would the pile look like? How high would the pile be? What kind of vegetation would be placed over the soil?

EPA Response: Although the details for this alternative would be part of the detailed design, the mound of soil probably would be between 10 and 20 feet high, the mound would be capped, and the final surface of the cap would be a grass cover. However, the steepness of the mound would affect the type of vegetation that could grow. The type of vegetation could have been specified in the Record of Decision. Before the soil is moved to the Main Plant Area, preparation of the Main Plant Area would be required, therefore, the collapsed quonset hut would be removed.

2. A representative of one of the PRPs and several area residents expressed formal opposition to the preferred alternative for the Former Disposal Area soils (FDA-S-8). Residents suggested the soil be left at the Former Disposal Area and treated or excavated and taken offSite.

EPA Response: As a result of public comment, EPA has reconsidered the Proposed Remedy and has made a modification. The remedy selected for the Former Disposal Area soils is FDA-S-4, Excavation and OffSite Treatment and Disposal. See page 60 of the Selected Remedy.

3. Will there be deed restrictions associated with the cap at the Main Plant Area and these restrictions also apply to the Former Disposal Area if EPA chose the cap alternative at the Former Disposal Area?

EPA Response: Yes, if a cap is placed over portions of the Site, EPA will place deed restrictions on the property to prevent any use that would adversely impact the capped area.

EPA would like to clarify the response given at the public meeting with respect to the restriction of the current business and implementation of a cap remedy. If the only remedy available to EPA restricted the current business operation, EPA would still have the authority to proceed. However, if an equally protective, cost effective remedy is available that would allow a business to continue operation then EPA's policy would be to look favorably on that alternative and consider it strongly for selection.

4. What will EPA do to maintain the cap and how long will EPA maintain the cap?

EPA Response: The purpose of the cap at the Main Plant Area is to reduce infiltration of precipitation through contaminated soil. Since contaminated soil will be left in place, EPA has incorporated 30 years of cap operation and maintenance (O&M) into the preferred clean-up alternatives at the Main Plant Area. The O&M is the responsibility of the party undertaking the remedial action which in this case will be either the responsible parties or EPA. If EPA were to perform the remedial action then EPA would enter into a Superfund State Contract with the Commonwealth of Pennsylvania to perform the Operation and Maintenance activities at the Site. The Site would be evaluated every five years by the responsible parties or EPA. If, after 30 years, EPA believes that the remedy has remained and will remain protective of human health and the environment, the site can be deleted from the National Priorities List. EPA believes there is a possibility that the operation and maintenance at the Main Plant Area could last longer than 30 years due to the suspected presence of dense non-aqueous phase liquids in the groundwater.

5. A resident commented that she has read articles which stated that a downside of the alternatives under consideration is the release of hazardous vapors in the air. The resident asked if EPA could promise that no such air pollution will occur with soil movement, pumps and wells.

EPA Response: Release of vapors during soil excavation activities may occur and these releases were considered in the evaluation of alternatives. However, air monitoring will be performed during the remedial action to ensure that the residents and Site workers performing the soil excavations are not exposed to unacceptable levels of contaminant vapors. Additionally, during the RI, air monitoring was performed during drilling activities and there was no indication of unacceptable levels of contaminant vapors. With respect to the groundwater treatment system, the air stripper exhaust will be treated using activated carbon adsorption or U/V oxidation. If responsible parties install the wells, they will need to work to resolve access matters.

6. If EPA proposes to excavate the soil at the Former Disposal Area and move it to the Main Plant Area Corrective Action Management Unit (CAMU), why not treat it once it is moved?

EPA Response: EPA did consider the ex-situ treatment of the Former Disposal Area soils in the

vicinity of the residences. However, EPA did not believe that the on Site treatment alternatives provided the best balance among the evaluation criteria. In addition, EPA considered treating the soils in-situ once they were placed back onto the ground at the Main Plant CAMU. Even with a CAMU designation, more stringent State environmental regulations could impact the placement of the soils after onSite treatment. The contaminants in the soil are listed hazardous wastes, therefore, the soil must be handled as a hazardous waste and certain stringent State and Federal regulations apply to the treatment and land disposal of the treated soil. Therefore even after treatment the soil may still require offSite disposal if certain treatment levels are not achieved. EPA did not see the benefit in treating the soil on-Site and possibly be required to still dispose off-Site. However, EPA has reconsidered moving the Former Disposal Area soils to the Main Plant CAMU and instead has selected Alternative FDA-S-4, Excavation, Off Site Treatment and Disposal.

7. A resident suggested that EPA further evaluate placing a cap over the contaminated soil at the Former Disposal Area rather than excavating it and moving it to the Main Plant Area.

EPA Response: EPA evaluated the use of a cap at the Former Disposal Area in the FS and believes the cap alternative does not provide the best balance of the evaluation criteria. However, EPA has reconsidered moving the Former Disposal Area soils to the Main Plant Area CAMU. See Response above.

#### C. The Preferred groundwater Alternatives

1. If Catanach Quarry closed, would the groundwater flow change?

EPA Response: The groundwater flow at the Main Plant Area is affected by pumping at the Catanach and Cedar Hollow quarries. If both quarries ceased pumping, the natural flow direction would be to the south.

2. Why is EPA proposing to reinject the treated water into the ground rather than discharging the water?

EPA Response: EPA believes that reinjection of treated groundwater into the aquifer is the most appropriate discharge method at this Site since it lies in the Valley Creek watershed. The Valley Creek has been designated an Exceptional Value Stream by Pennsylvania and EPA prefers not to discharge to Valley Creek in this case. EPA would like to clarify the response given at the public meeting regarding discharge to Valley Creek. Although EPA has selected reinjection for the Malvern Site, if EPA determined that other discharge options were not available or effective, EPA could opt to discharge to Valley Creek.

3. To where will EPA reinject the water after it has been treated?

EPA Response: EPA will reinject treated water from the Main Plant Area into injection wells located on property owned by East Whiteland Township east of the Main Plant Area and west of Phoenixville Pike. Since EPA has selected Natural Attenuation at the Former Disposal Area, reinjection of water will not be required.

4. Is the land on which EPA proposes to place the reinjection wells, and which EPA stated was owned by East Whiteland Township, the same land located along Phoenixville Pike that is deeded as recreational land for the Aston Woods Development?

EPA Response: The parcel of land where EPA proposes to place the reinjection wells runs along the fence line of the Main Plant Area adjacent to Phoenixville Pike. The area currently is

wooded and several monitoring wells are located on the property EPA has been coordinating with East Whiteland Township Board of Supervisors who have commented on the use of the land for placement of injection wells.

5. Is EPA required to obtain permission from East Whiteland Township to install the reinjection wells on the township's property?

EPA Response: Because of overriding federal authority, strictly EPA is not required to do this. However, EPA plans to work cooperatively with the East Whiteland Township Board of Supervisors to obtain their consent for access for the installation of the reinjection wells. EPA incorrectly responded at the public meeting that permission from the East Whiteland Township Board of Supervisors would be required, because our policies generally encourage us to work out access issues in a cooperative spirit with other government agencies. If responsible parties install the wells, they will need to work to resolve access matters.

6. How will EPA get approval from the East Whiteland Township Board of Supervisors to install the reinjection wells on the township's property?

EPA Response: As clarified above, it is EPA's practice to coordinate such access issues with property owners. EPA coordinated access with the Township for the installation of monitoring wells for the RI activities. EPA has received the Township's comments on the Proposed Plan and use of the property. See Part II, Section B.

7. At what concentration of contaminants will EPA turn off the groundwater pump-and-treat system at the Former Disposal Area?

EPA Response: EPA has made a modification from the Proposed Remedy at the Former Disposal Area from FDA-G-6 (Groundwater Collection and Treatment of Source Well) to FDA-G-4 (Natural Attenuation). Therefore, although the selected remedy at the Former Disposal Area is not an active pump and treat system, the remediation through natural attenuation will continue until the groundwater reaches drinking water standards (ie. MCLS).

8. What is the cost per ton of removing and treating the contaminants which the pump-and-treat system will remove from the groundwater?

EPA Response: EPA does not have a estimate of cost per ton. EPA has tried to provide an estimate of the cost per gallon using the cost estimate of Alternative MPA-G-6 provided in Appendix C of the FS. However, it is very difficult to estimate the volume of water that will require treatment since the plume at the Main Plant Area may not be clearly defined.

9. Once the pump-and-treat system is started, what will be done to replace the water being removed from the aquifer? What prevents water from the surrounding areas from getting into the pump-and-treat system?

EPA Response: 1) The water being removed from the aquifer will be treated and reinjected. 2) The objective of pump and treat is to draw contaminated groundwater towards a well where it is extracted for treatment. The extent of the capture zone is related to the pumping rate within the well. This rate can be adjusted to minimize capture of uncontaminated water.

10. Did EPA consider constructing a physical barrier to prevent the contaminated water from migrating?

EPA Response: Barrier technology is applied to shallow unconsolidated material which is not the case at this Site. The Malvern Site is located in complex bedrock geology and barrier technology

is inappropriate.

11. A representative from the law firm of Drinker, Biddle, and Reath expressed his firm's formal opposition to the preferred groundwater alternatives for the Former Disposal Area and Main Plant Area.

EPA Response: EPA has considered this comment in the final remedy selection. See Part II, Section, #2 of this Responsiveness Summary.

12. Why is EPA proposing to treat the groundwater at the Former Disposal Area if EPA also claims the water cannot be contained? Why spend the money to pump and treat the water to remove only a portion of the contamination?

EPA Response: EPA proposed to pump the source area in the central portion of the groundwater plume in an effort to reduce contaminant mass remaining in the aquifer and to expedite the cleanup. However, EPA has reconsidered the proposed cleanup of the Former Disposal Area groundwater and has selected Natural Attenuation of the groundwater at the Former Disposal Area. See Part II, Section C, #2 of this Responsiveness Summary.

13. Who currently uses the water flowing from the Site and who could possibly use it in the future?

EPA Response: Currently, residents who live in Hillbrook Circle and residents living along Conestoga Road and Phoenixville Pike use water that flows from the Site. Future residents who build homes and drill wells in the affected area could be impacted.

14. Instead of installing the reinjection wells on the township's property, could EPA install the wells on the Balderston property?

EPA Response: EPA considered installing the reinjection wells in an upgradient location on the Balderston property when evaluating the alternatives in the FS. However, groundwater modeling in the FS indicates that if reinjection wells are placed on the downgradient end of the contaminant plume on the township property, the reinjected water will act as a hydraulic barrier and reduce the potential of plume migration.

15. A resident expressed his formal support for EPA's preferred alternatives to cleanup the Malvern Site. He particularly supported the collection, treatment, and discharge of the groundwater.

EPA Response: EPA has considered the comment in the final remedy selection. EPA has endeavored to select a remedy that is acceptable to the community.

D. The Preferred Water Supply Alternative

1. Will EPA connect all residents along Phoenixville Pike to public water?

EPA Response: The final selected remedy requires the connection of all impacted or potentially impacted residences to the public water supply. This includes residences along Phoenixville Pike that are currently part of the Domestic Well Management Plan. See Table 14 of the ROD.

2. Which homes on Hillbrook Circle would EPA connect to public water?

EPA Response: The final selected remedy requires the connection of all impacted or potentially impacted residences to the public water supply. This includes all residences on Hillbrook Circle

that are currently part of the Domestic Well Management Plan. For a complete list of residents, see Table XX of the ROD.

3. How will EPA be able to monitor the movement of contaminants if the wells around Hillbrook Circle are abandoned?

EPA Response: The domestic wells in Hillbrook Circle are not specifically designed or constructed for monitoring purposes. Therefore, the abandonment of these wells will not impact the monitoring of the groundwater plume. A monitoring system, which will include the installation of new monitoring wells, will be installed to monitor the groundwater.

4. Will Philadelphia Suburban Water Company have rights to the aquifer?

EPA Response: Water use rights issues are generally beyond the scope of EPA's activities. With regard to the Malvern Site, however, EPA's remedy specifically prohibits use of contaminated groundwater by anyone, in order to protect public health. EPA can lift this restriction after the aquifer is remediated.

5. A representative from the law firm of Drinker, Biddle, and Reath expressed his firm's formal approval of EPA's preferred water supply alternative. His firm believes that the key clean-up issue is preventing residents from drinking the water.

EPA Response: EPA has considered this comment and has selected the provision of a public water supply in the final remedy selection. EPA has also selected institutional controls to prevent use of contaminated groundwater.

6. Why is EPA proposing to spend money to cleanup the groundwater if EPA also proposes to connect residents to the public water supply?

EPA Response: EPA is continually faced with the challenge of ensuring adequate and safe drinking water supplies, now and in the future. "Writing off" existing potential supplies because of chemical contamination increasingly reduces the country's ability to assure adequate, clean supplies over time. Several federal requirements therefore apply to this important water resource. The National Contingency Plan (NCP) at 40 C.F.R. Section 300.430 requires that groundwater be restored to its beneficial use, which at the Malvern TCE Site is a current drinking water supply. Also, the Selected Remedy must meet all ARARs, which require remediation of groundwater to MCLs.

7. How can residents be sure that the public water will be of better quality than the well water they currently drink? Will the water be tested?

EPA Response: The responsibility for ensuring the quality of the drinking water rests with the water provider, Philadelphia Suburban Water Company. The water provider is required to monitor the public water supply to ensure that the supply is in accordance with the federal Safe Drinking Water Act (SDWA), 42 U.S.C. 300f to 300j-26. The Act establishes enforceable, health-based drinking water standards.

8. A resident expressed his appreciation for EPA's response to the situation. This resident also was concerned about miscommunications that occurred since EPA knew about contamination in residential wells during the 1980s. The only reason he found out that his well was contaminated was because his well went dry in 1991 and he had to have his new well water tested.

EPA Response: EPA understands the resident's concern and will try to alleviate this problem in

the future. Since EPA's Office of Superfund Programs assumed the remedial activities at the Site, there has been an extensive outreach to the surrounding residents. EPA will continue this outreach through the completion of the remedial activities.

9. A representative from one of the PRPs suggested that the Malvern Site is an appropriate site to use PADEP's new Act II Program and Site Specific Remedies.

EPA Response: EPA has considered the applicability of the Land Recycling and Environmental Remediation Standards Act ("Act 2") to the Selected Remedy at the Malvern Site. However, EPA does not believe Act 2 to be an ARAR for the Selected Remedy. EPA will continue to work with PADEP in implementing an appropriate cleanup at the Site.

10. Will EPA pay for the expense of connecting Hillbrook Circle residents to the public water supply?

EPA Response: The cost of connecting Hillbrook Circle residences to the public water supply will be addressed by the Selected Remedy which as required by CERCLA is the responsibility of the Responsible Parties. The residents will be responsible for water usage.

11. If residences are connected to the public water supply, will EPA dispose of the contaminated filters currently in place?

EPA Response: The disposal of the filtration units and filters is a performance standard of the Selected Remedy, and will be conducted by either the PRPs or EPA. See page 53 of the ROD.

12. A resident inquired why some of the homes near the Site did not have filtration systems installed on their wells. This resident did not have one and requested that EPA place a filter on his well until his home is connected to the public water supply.

EPA Response: EPA monitors well data for all homes in the Domestic Well Management Plan on an annual basis and some homes on a bi-annual basis. The only homes that are currently on filters are those that are above MCLs, levels that have been established by the Safe Drinking Water Act. Homes that have not been placed filters have not had an exceedance of an MCL for the contaminants of concern.

#### E. Bioremediation

1. Why hasn't EPA considered using bioremediation and air injection to cleanup the contaminated soil?

EPA Response: EPA did consider both bioremediation and air injection for remediating soils at both the Main Plant Area and the Former Disposal Area. Various technologies screened for the soils at the Former Disposal Area and Main Plant can be found in Tables 3-2 and 3-4 of the FS. At both locations, bioremediation of soils was rejected as a technology because the aerobic biodegradation of chlorinated compounds has not been found to be effective. Air injection was considered under the description of Soil Vapor Extraction (SVE). In this process, the volatile organic compounds are volatilized by forcing air through the subsurface and removing the air for treatment. Although SVE at both the Former Disposal Area and Main Plant Area was retained as a cleanup alternative, EPA believes the FDA-S-4, Excavation, OffSite Treatment and Disposal of Soils and MPA-S-3, Capping Soils at the Main Plant, provide the best balance among the nine criteria.

2. A resident noted that she had read some articles in the Philadelphia Inquirer and the New York Times about bioremediation. She inquired if EPA had considered using that

technology to cleanup the contamination at the Site or combining it with another clean-up method.

EPA Response: EPA considered bioremediation early in the Feasibility Study (FS) as discussed above including consideration of technical studies, however, EPA did not specifically evaluate the articles the resident referenced.

F. Responsibilities of the PRPs

1. Will the PRPs be responsible for providing the money for the cleanup as soon as the ROD is issued?

EPA Response: Once EPA selects the final clean-up plan, EPA will initiate negotiations with the PRPs to conduct the clean-up activities which consists of design of the remedy, then implementation, followed by long-term operation and maintenance. These negotiations typically take several months.

2. How often do PRPs cooperate with EPA?

EPA Response: PRPs often cooperate with EPA and conduct the necessary activities to cleanup a hazardous waste site. EPA estimates that PRPs conduct the remedial activities at approximately 70% of the Superfund Sites.

3. If Chemclene had liability insurance to cover the costs of cleaning up the site, would the generator PRPs also be responsible for the clean-up costs?

EPA Response: If Chemclene had liability insurance to cover the cost of the cleanup, the owner could attempt to access this to perform the remediation at this Site. However, under law, most PRPs are jointly and severally liable for cleanup costs.

4. Has EPA investigated Chemclene's insurance records from the year the company began operations to determine if there is insurance coverage that could be used to pay for the cleanup?

EPA Response: EPA is currently conducting an extensive investigation of all of Chemclene's financial records.

G. The Time Frame for the Remedial Action

1. While the question of who will pay for or conduct the cleanup is being resolved, will further clean-up actions stop?

EPA Response: The formal settlement process and a 120 day moratorium on further EPA actions begin with the issuance of special notice letters to the PRPs. Special notice letters are authorized by CERCLA when EPA determines that a period of negotiation would facilitate an agreement with PRPs for taking a response action. Once special notice letters are issued, a 60-day moratorium period is required. This allows the PRPs that time to submit a good faith offer to perform the work. If such an offer is received, the moratorium is extended an additional 60 days.

2. If the issue of funding the cleanup goes to litigation, will the cleanup wait until the court battle is settled?

EPA Response: No. If the PRPs do not present a good faith offer to EPA within 60 days after the



issuance of the special notice letters, EPA has the enforcement option to require the PRPs to fund the cleanup, or EPA may start the clean-up process using Superfund money. If EPA uses money from the Superfund to fund the cleanup, EPA may recover those costs later through litigation.

3. When will EPA make a decision about the final clean-up plan and when will the actual cleanup be started?

EPA Response: The public was requested to submit comments and questions about the Proposed Plan to EPA by September 2, 1997. EPA has considered all comments and questions in the selection of the final remedy. With issuance of the ROD, EPA will begin negotiations with the PRPs regarding who will conduct or pay for the cleanup. The negotiations could take several months. It is likely that the design of the remedy will begin in late 1998 and construction may begin in late 1999.

#### H. The Site's Impact on the Surrounding Community

1. If the property were no longer used and institutional controls were in place, would those facts significantly change the risk of human exposure to contaminants?

EPA Response: Yes. Although highly unlikely, if the Chemclene property no longer were used and institutional controls were in place, there would be no exposure to contaminants and therefore no risk. However, contaminants would remain, potentially causing future problems. Institutional Controls would include prohibiting use of groundwater throughout the entire area of the plume. This will be a challenge to fully enforce.

2. Does contamination from the Site impact Valley Creek?

EPA Response: EPA has sampled surface water on the Site and in Valley Creek and has determined that contaminants from the Site surface water have not impacted surface water in Valley Creek.

3. A pipe designed to collect storm water and run-off from Phoenixville Pike is being installed in the Charlestown Oaks Townhouse Development above the Aston Woods Development. The pipe discharges to Valley Creek. If contaminated water were picked up in the pipe, would it be discharged into Valley Creek?

EPA Response: See Response H.2 above.

4. How much of the clean-up activities will be visible from Phoenixville Pike and the Aston Woods Development? What will the clean-up activities look like and how long will they last?

EPA Response: The exact details of the clean-up activities will be determined in the remedial design. However, it is quite possible that some cleanup activities will be visible from Phoenixville Pike and Aston Woods. EPA estimates that construction could take up to two years.

5. What would the risk be to human health if EPA only connected residences to public water, placed deed restrictions on the property, and fenced and capped the area?

EPA Response: If EPA connected residences to the public water supply, placed deed restrictions on the property, and fenced and capped the area, there would be no exposure to contaminants, therefore there would be no current risk to human health. However, contaminants would remain, potentially causing risk to people in the future.

6. In the past, did the Site contamination impact the high school? Will the site cleanup

impact the high school in the future?

EPA Response: EPA's studies indicate that soil contamination is confined to the Chemclene property and has not impacted the High School. In addition, the High School uses public water supplied by PWSC. Groundwater contamination flows to the northeast from the Main Plant and the High School is located to the southeast. During the RI at the Site, EPA conducted air monitoring which indicated that there were no unacceptable levels of contaminants in the air.

For future impacts see Response B.7 above.

7. Is there a record of any of the high school students coming into contact with the Site contaminants? This inquiry was based on knowledge that the high school's cross country team used to run across the Chemclene property during practice, biology classes studied nearby wetlands, and children living in Aston Woods crossed the property as a shortcut.

EPA Response: EPA pointed out that the Former Disposal Area and Main Plant Area previously were and currently are fenced. Therefore, if students crossed the property it was most likely property next to the Site which Mrs. Balderston used to own and which the Springridge Development Corporation currently owns. That property is not contaminated. In addition, the surface soils on the areas of concern at the Site do not pose an unacceptable risk. It is the subsurface soils at the Main Plant Area that pose an unacceptable risk.

8. Does EPA need the approval of the East Whiteland Township Board of Supervisors to go ahead with the cleanup?

EPA Response: No. EPA does not need the approval of the East Whiteland Township Board of Supervisors to proceed with the clean-up plan. However, EPA will work cooperatively with the township in the implementation of the Selected Remedy.

9. Will residents living near the Site be able to sell their homes without suffering a loss?

EPA Response: Residents impacted or potentially impacted by the Site have been identified and will be provided public water. EPA often receives inquiries from real estate agents and explains the facts about the Site to them. However, EPA has no information about whether real estate values near this Superfund Site may have been impacted. Existence of contamination could possibly affect real estate values. EPA plans to ensure cleanup and control of this contamination, thus, over time, benefitting real estate values.

10. Why didn't EPA warn people in the past about the potential risks associated with the Site?

EPA Response: The potential risk to surrounding residents is primarily due to the use of groundwater. The residents using groundwater that have been impacted have been placed on carbon filters to remove contaminants. In addition, routine sampling of potentially impacted residents that are not contaminated has been performed to ensure the condition does not change. EPA has learned that newer residents moving to Hillbrook Circle were not made aware of the groundwater contamination when their homes were purchased. EPA has implemented a Community Relations Plan at the Site and will continue this outreach through the completion of the remedial activities.

11. Has EPA considered using Brownfields as a standard for cleaning up the site?

EPA Response: "Brownfields " is EPA's term for minimally contaminated urban sites on which we seek to encourage redevelopment. The Chemclene property is highly contaminated and thus, is has been listed on the NPL.

12. If EPA does not cleanup the Site, will it threaten Valley Creek?

EPA Response: Yes, it is possible that Valley Creek could be impacted if the Selected Remedy is not implemented.

13. Instead of spending \$14 million for the proposed alternatives, EPA should purchase all the homes affected or potentially affected by the contamination, relocate the homeowners, and declare the area uninhabitable.

EPA Response: The Selected Remedy provides protection of human health and the environment and therefore, there is no need to declare the area uninhabitable.

#### I. The Contamination

1. How will EPA ensure that the Site will not be contaminated further?

EPA Response: Chemclene is not permitted to accept any hazardous waste at its property. The company has a permit with the East Whiteland Township Fire Marshall to store hazardous materials. The Fire Marshall also periodically inspects the facility. Chemclene is prohibited from treating, storing, or disposing of hazardous wastes on the property. Chemclene's hazardous waste handling practices were the original cause of the contamination.

2. How did EPA determine that a nearby septic tank cleaner was not the cause of the contamination in the southwest corner of Hillbrook Circle?

EPA Response: EPA has responded to this comment below in Part II, Section C, #1.

3. Prior to 1980, was there an analysis conducted of Hillbrook Circle's drinking water?

EPA Response: EPA does not believe that the drinking water around Hillbrook Circle was analyzed prior to 1980.

4. Are there hazardous contaminants in the groundwater at the Site that also are found in the groundwater at the Catanach Quarry?

EPA Response: It is EPA's understanding that TCE has been detected at the Catanach Quarry. However, EPA has not determined that the Malvern Site is the source of this contamination. Further investigation of the extent of the contaminant plume at the Main Plant Area will be conducted during Remedial Design.

#### Part II: Summary of Commentors' Major Comments and Questions Received in Writing During the Public Comment Period

This section provides technical detail in response to comments or questions on the Malvern Site. EPA received these comments or questions in writing during the public comment period. These comments or questions may have been covered in a more general fashion in Part I of this Responsiveness Summary. The following specific comments are addressed:

- A. Comments of North Industrial Chemicals, Inc.
- B. Comments of East Whiteland Township

- C. Comments of Environmental Resources Management (ERM) on behalf of the Malvern Site Study Group, a PRP group
- D. Comments of David DeWitt on behalf of the Concerned Residents of East Whiteland Township (CREW)
- E. Comments of Fox, Rothschild, O'Brien & Frankel, LLP and Walter B. Satterthwaite Associates Inc. on behalf of the Malvern De Minimis PRP Group
- F. Comments of United States Department of Interior
- G. Comments of Mr. & Mrs. Charles Kocher
- H. Comments of Pennsylvania Environmental Defense Foundation

- A. Comments of North Industrial Chemicals, Inc.

In a one-page letter dated July 16, 1997, Jack Hammond, a representative of North Industrial Chemicals Inc., submitted comments to EPA regarding the Malvern TCE Proposed Plan.

- 1. Why did EPA favor Chemclene when considering methods to cleanup the Site contamination? The proposed alternatives work around Chemclene's current operations thereby increasing the cost of the remediation and the risk of additional contamination.

EPA Response: See Response E.6, page 39 of this Responsiveness Summary.

- B. Comments of East Whiteland Township

In a one-page letter dated August 15, 1997, J. Donald Reimenschneider, East Whiteland Township Manager, submitted recommendations on behalf of East Whiteland Township regarding EPA's proposed alternatives for the Malvern Site.

- 1. EPA should convey the treated groundwater to the six proposed injection wells on the township property using underground piping.

EPA Response: EPA understands the Township's concern regarding the construction of the injection well system and will work with the Township during Remedial Design to address such concerns.

- 2. EPA should place protective fencing around each of the proposed injection wells.

EPA Response: It is possible to construct flush mount injection wells and therefore, fencing would not be required. However, these details will be addressed during the Remedial Design and EPA will take the Township's concern under consideration during the design.

- 3. EPA should be responsible for maintaining the injection wells, including capping and filling them upon decommissioning. Well abandonment must comply with County Health Department regulations.

EPA Response: The Selected Remedy addresses the issues raised in this comment. Please see page 57, of the ROD.

- 4. EPA should provide public water, at EPA's expense, to the Hillbrook Circle residences and other residences whose wells were affected by Chemclene.

EPA Response EPA agrees and has selected the Public Water Supply Alternative for the provision of public water. See ROD page 52. Under CERCLA, remedy costs will ultimately be borne by the Responsible Parties, even if the Fund pays for the remedy.

C. Comments of Environmental Resources Management (ERM) on Behalf of the Malvern Site Study Group, a PRP Group

In a 82-page document dated August 29, 1997, ERM, on behalf of the Malvern Site Study Group, submitted comments on the Proposed Plan and RI/FS for the Malvern Site. The comments and responses are summarized below.

1. EPA incorrectly identified the Malvern Site as the source of contamination for several domestic wells in the southwest corner of Hillbrook Circle. The Former Disposal Area is not the source of the volatile organic compound (VOC) contamination in the area of DW-058. The exact source currently is undefined, but may be related to historical use of chlorinated solvent products to unclog a septic system drain field.

EPA Response: EPA disagrees and believes the facts show otherwise. Precise delineation of contaminant distribution in this area is difficult due to the reliance on active residential wells of varied construction for monitoring purposes. Contaminant levels in this area are also very low and the relatively flat potentiometric surface compounds the difficulty of defining an exact plume outline. Acceptance of whether Hillbrook Circle development is impacted by one dispersed low level plume or a possible second source of contamination does not affect EPA's selection of a remedial action for domestic wells in the development. Continued use of wells in the development represents the potential for spreading of contamination to previously uncontaminated wells.

Therefore, the proposed remedy of connecting all residents in the Hillbrook Circle development, on Phoenixville Pike, and on Conestoga Road to public water supplies still offers the best protection for residents in the area.

ERM's interpretation of the local groundwater flow in the area around the Former Disposal Area appears flawed and incompatible with realistic interpretation of the regional potentiometric surface map developed by USGS. This potentiometric surface map (McManus and Sloto, 1997: Plate 1) indicates that groundwater flows south/southwest from the Former Disposal Area through the Hillbrook Circle development, and then intercepting Valley Creek where potentiometric lines form an acute angle (304 feet NGVDD 1929) north of Conestoga Road. ERM's hypothesis that groundwater flows from the Former Disposal Area to the northeast toward the quarry complex under the flow regime mapped by USGS would require the groundwater flow direction to change greater than 90 degrees after leaving the Former Disposal Area, with flow moving from an area of lower to higher potentiometric head across a well defined groundwater divide. A northeastward flow direction was discussed in the RI report as a transient occurrence coinciding with elevated pumping at the quarries, but not suggested for the potentiometric surface developed by USGS.

2. EPA concluded that natural attenuation processes are reducing contaminant concentrations in the Site groundwater and are inhibiting the migration of Site contaminants. However, EPA failed to incorporate significantly natural attenuation into the Proposed Plan.

EPA Response: EPA did incorporate natural attenuation in the Proposed Plan by proposing FDA-G-6, groundwater extraction and treatment, at the Former Disposal Area. This alternative focused pumping on the source area of the contaminant plume at the Chemclene property and allowed natural attenuation of the plume off the Chemclene property. And, as explained below, EPA has determined Natural Attenuation to be acceptable, provided it can meet required cleanup levels in accordance with Section X.E of the Selection Remedy.

As indicated in the RI Report, CAH's in the contaminant plume emanating from the Former Disposal Area exhibit significantly elevated concentrations of degradation products of TCE, 1,1,1-TCA,

and PCE. At several monitor wells, concentrations of degradation products exceed the concentrations of more halogenated and chlorinated CAH's. Additionally, evaluation of historical data indicates that concentrations of CAH's in monitor wells at the Former Disposal Area, and nearby domestic wells have been decreasing with time since the last removal of drums at the mounded area in 1990. With time, the contaminant plume should continue to recede. Modeling of the contaminant plume using a series of first order equations indicated that contaminant concentrations should decline below MCL's within 16.5 years (CH2M HILL, 1997). Due to the inherent uncertainty associated with modeling it was EPA's initial position that a short term active pump and treat remedy would remove these doubts by expediting natural attenuation process. However, EPA has re-evaluated this approach and has concluded that the overall risk of a natural attenuation remedy at the Former Disposal Area is acceptable if the 52 residential wells around the Site are connected to public water supplies. In addition, these domestic wells need to be abandoned to prevent further exposure to the residents, or converted to monitoring wells. This remedy, like all remedies, can be reevaluated based on measurable performance.

3. EPA did not adequately account for the presence of dense non-aqueous phase liquids (DNAPLs) in groundwater around the Main Plant Area. EPA's proposed remedial action would be technically impractical and ineffective in the presence of DNAPLs. Due to the presence of DNAPL's, EPA will not be able to meet groundwater applicable or relevant and appropriate requirements (ARARs) in the long-term.

EPA Response: EPA disagrees. ERM's presumption that EPA ignored the presence of dense non-aqueous phase liquids (DNAPL's) in selecting a remedial alternative for groundwater at the Main Plant Area is false. Alternative MPA-G6, Groundwater Collection, Treatment of Source Area, and Discharge, was selected to reduce contaminant mass in the center of the groundwater plume and control migration of contaminants offSite. At the same time, mechanisms of natural attenuation as discussed in the RI Report, will help eliminate contaminants from the peripheral areas of the plume. This approach is clearly stated in the Proposed Plan. EPA acknowledges that achieving chemical specific ARAR's for groundwater using pump and treat technology in the presence of DNAPL's is difficult and may be technically impracticable. A number of technical issues were considered for the selection of Alternative MPA-G-6. These issues were balanced against the need to protect public health and groundwater supplies. (The NCP mandates that polluted groundwater be restored to beneficial use regardless of whether it is used for current public drinking water supplies.) The selected alternative was intended to reduce the contaminant mass in the most highly contaminated plume area and decrease the extent of the contaminant plume. If it becomes evident that the area of highest contamination can not be remediated to MCLs, this area will be considered for a technical impracticability waiver as discussed in the ROD, page 64. This waiver will only change the cleanup standards for the area where the present standard cannot be met. No design changes to the treatment system would be required. The only practicable change to the system would be the re-designation of some remedial wells to containment wells.

EPA has selected Alternative MPA-G-6, Groundwater Extraction and Treatment, as the remedial alternative for groundwater at the Main Plant Area because there is no significant design difference between this alternative and one that provides a technical impracticability waiver for the area of highest groundwater contamination. Any future changes to this approach can be made based on remedial action monitoring data. EPA believes this approach recognizes the difficulty of remediating groundwater within the facility boundaries of the Main Plant Area, as well as the benefits of natural attenuation to any active pump and treat design.

4. EPA failed to incorporate the site-specific clean-up levels approach to the conditions at the Site allowed under Pennsylvania's Land Recycling and Environmental Remediation

Standards Act (Act 2), despite identifying the Act as an ARAR.

EPA Response: EPA did not identify Act 2 as an ARAR for this Site. The table that ERM is referring to in the FS is entitled preliminary. A final ARARs determination is made as part of the remedy selection. EPA coordinated with PADEP throughout the remedy selection process.

5. EPA did not apply the Technical Impracticability (TI) Guidance for Groundwater for the likely presence of DNAPLs below the water table at the Main Plant Area.

EPA Response: EPA has considered this guidance as discussed above in response #2.

6. EPA did not consider the effects of the presence of DNAPLs on soil remediation properly.

EPA Response: EPA did consider the effects of DNAPLs on soil remediation. The remedial alternative for groundwater was based on a conservative approach in regard to protection of groundwater supplies, consistent with the NCP. This conservative approach considered that the contaminant mass in plume at the Main Plant Area could be reduced while preventing additional downgradient migration of the plume. If DNAPL is present, pumping at the source area will contain its migration and recover a certain volume. Consistent with a conservative approach to groundwater remediation, soil alternatives were developed to prevent additional leaching of contamination to groundwater from the unsaturated soils. As the presence of DNAPL has not been definitively demonstrated EPA believes remediation of soil either through soil vapor extraction (SVE), soil flushing, or prevention of additional leaching with capping, could aid in the remediation of a dissolved-phase plume by removing the source in the vadose zone. However, since EPA believes implementation of the cap at the Main Plant Area provides adequate protection of groundwater, EPA has reconsidered the adoption of SVE at the Main Plant Area.

6. EPA did not conduct pilot studies of soil vapor extraction (SVE) to determine if the technology would be effective under specific site conditions.

EPA Response: EPA had planned a Pilot Study for the Fall of 1997 at the Main Plant Area to determine the effectiveness of SVE. However, since EPA has not selected SVE at the Main Plant Area, the Pilot Study was determined to be unnecessary. Instead, EPA will be using MPA-S-3, Capping at the Main Plant Area.

7. EPA did not consider the cost-effectiveness of natural attenuation as a realistic permanent solution for groundwater remediation.

EPA Response: EPA has considered the cost effectiveness of natural attenuation as discussed in Response #2 above. Additionally, EPA has reconsidered the cost effectiveness of natural attenuation (Alternative FDA-G-4) for implementation at the Former Disposal Area in lieu of the pump and treat alternative (FDA-G-6) described in the Proposed Plan. In accordance with the NCP, cost effectiveness is part of the nine evaluation criteria for selecting a remedial alternative. Cost effectiveness is grouped with four other, criteria that are known as primary balancing criteria for selecting an alternative. For EPA, the balancing criteria are secondary to the two threshold criteria in selecting an alternative:

1. Overall protection of human health and environment
2. Compliance with Applicable or Relevant and Appropriate Requirements

EPA reconsidered FDA-G-4, Natural Attenuation, because the alternative meets the two threshold criteria at the Former Disposal Area and decided to select it.

However, this is not the case at the Main Plant Area. Cost effectiveness of a natural attenuation alternative (MPA-G-4) over groundwater extraction alternatives (MPA-G-5 and G-6) at the Main Plant Area was not considered appropriate because natural attenuation is not protective of human health and the environment at the Main Plant Area.

Although a number of techniques were performed on analytical data during development of the RI Report, a reasonable mechanism for natural attenuation (anaerobic degradation, dehalogenation, hydrolysis) could not be definitively identified that explained the attenuation of Chlorinated Aliphatic Hydrocarbons (CAHs) at the Main Plant Area. In light of this uncertainty, and estimations of an extended period for constituents to attenuate below MCLs (35 years), natural attenuation was not considered as a sole alternative for groundwater remediation at the Main Plant Area. Consequently, a cost effectiveness analysis was not warranted.

8. EPA should have concluded that the proposed Main Plant Area groundwater alternatives could violate the remedial action objectives (RAOs) by increasing the plume movement off the property.

EPA Response: EPA disagrees with ERMs interpretation. The remedial action objective is to restore the Site groundwater to a beneficial use through removal and treatment of the contaminated groundwater. The Site is defined as the area impacted groundwater contamination. To achieve this objective, contaminated groundwater will be pumped to extraction wells both on the Chemclene property and off the Chemclene property. This action by definition draws contamination to the extraction wells. The placement of extraction wells on the Chemclene property will be designed to keep the most contaminated groundwater from migrating off the Chemclene property. Off property extraction wells will be designed and placed to as to not adversely impact the purpose of the extraction wells on the Chemclene property.

9. EPA did not evaluate integrated Site-wide alternatives, even though various remedial actions for specific areas or media interrelate and, in some aspects of the Proposed Plan, are redundant for meeting the RAOs.

EPA Response: EPA elected to address the Site in this manner because the Site contains two areas of concern, each with at least five alternatives for soil and groundwater. Integration of Site-wide alternatives results in a large and unruly number of combinations of alternatives for evaluation. In addition, the groundwater and source control alternatives at each area are relatively independent of each other. An evaluation of Site-wide alternatives is not required by the NCP. Such an evaluation at this Site would generate an excessive number of permutations for alternatives, there would not be much value added, and would detract from the clarity of the FS.

The physical characteristics of the Site accommodates a thorough evaluation of alternatives for specific media at each area of concern. The Former Disposal Area and Main Plant Area are separated by 1,900 feet. Although the two areas of concern overlie the same aquifer, the areas appear to be separated by a groundwater divide. Subsequently, integrating remedial elements for both sites such as a common groundwater or soil vapor treatment plants would be difficult to accomplish without significant costs for conveying media between sites for treatment.

10. EPA did not apply all elements of the Common Sense Initiative to the proposed alternatives.

EPA Response: EPA's decision making at Superfund Sites is guided by the National Contingency Plan. In contrast, the Common Sense Initiative focuses on ongoing pollution reductions in agency regulated business sectors. In any event, EPA endeavors to use common sense in all its decision



making.

11. ERM suggested the following remedial actions for the Main Plant Area:
  - D continue operation of the carbon filters until public water is available;
  - D connect one- Phoenixville Pike residence and the Main Plant Area to public water;
  - D restrict the property to industrial/commercial use;
  - D place an asphalt cap over contaminated soils;
  - D place institutional controls on the site to prevent future groundwater use at the MPA; and
  - D monitor groundwater to ensure that natural attenuation continues to remove contamination and limit the extent of the plume.

EPA Response: EPA has considered ERM's suggestion and although EPA has made modifications from the Proposed Plan, EPA does not believe ERM's suggested remedial actions for the Main Plant Area, in its entirety, provides the best balance of the evaluation criteria.

12. ERM suggested the following remedial actions for the Former Disposal Area:
  - D continue the operation of carbon filters until public water is available;  
connect affected residents on Hillbrook Circle to public water;
  - D remediate Former Disposal Area soils by either in-situ treatment or excavation/on-site treatment and replacement;
  - D monitor the groundwater to ensure that natural attenuation continues to remove contamination and limit the extent of the plume.

EPA Response: EPA has considered ERM's suggestion and although EPA has made modifications from the Proposed Plan, the Agency does not believe ERM's suggested remedial actions for the Former Disposal Area, in its entirety, provides the best balance of the evaluation criteria.

13. Extensive comments were received from ERM regarding the Risk Assessment contained in Section 6 of the Remedial Investigation. ERM identified the following issues as errors of significance:
  - D Inclusion of natural background metals as chemicals of potential concern (COPCs)
  - D Misidentification of potential receptors and use of unrealistic exposure scenarios
  - D Use of historical data maximum concentrations for calculation of future off-site groundwater risks
  - D Evaluation of TCE and PCE as carcinogens
  - D Evaluation of Class C compounds as carcinogens

These issues are addressed in detail below, referencing the specific sections in which they are discussed in the ERM document which can be found in the Administrative Record for the Site.

EPA disagrees with ERM's conclusions regarding the Risk Assessment and has not made any changes based on these comments. A detailed response is provided below.

EPA Response:

ERM Section 2.4.1.1, Chemicals of Potential Concern

Metals

As ERM suggests, many of the inorganic COPCs detected in site soils and Main Plant Area groundwater can be found naturally in the environment. To address this possibility, current Environmental Protection Agency (EPA) risk assessment policy recommends comparing on-site

data to site-specific background data. (Note that when making site-specific decisions regarding the elimination of COPCs, it is inappropriate to compare site data to background ranges from the general literature for the entire Eastern United States, as proposed by ERM). At the Malvern TCE Site, a statistical comparison of Site-related soil and groundwater concentrations to Site-specific background soil and groundwater concentrations was performed, and only the inorganics present at levels statistically above background -- and greater than respective Risk-Based Concentrations (RBCs) -- were retained as COPCs in the risk assessment.

Regarding ERM's comment that several background concentrations used for COPC screening do not correspond to background data reported in the RI, the following point should be noted. In the risk assessment, the maximum detected concentration of each inorganic constituent on-Site was compared to the 95% Upper Tolerance Limit (UTL) for background constituents. The 95% UTL does not necessarily equal any single background detection; rather the 95% UTL provides a statistical representation of the complete background data set.

ERM questions the appropriateness of evaluating iron in the risk assessment, stating that "iron is not even a CERCLA hazardous substance, and is therefore not regulated under Superfund." However, iron is included on the Superfund Target Analyte List. It is current EPA risk assessment policy to evaluate the risks associated with all constituents which are analyzed for and detected at a Site in excess of RBCs. At the Malvern TCE Site, iron falls into this category and was, consequently, carried through the quantitative risk assessment.

In general response to ERM's false claim that naturally-occurring metals in groundwater (and soil) were improperly carried through the risk assessment, it should be noted that the inorganic constituents retained as COPCs in Main Plant Area groundwater do not significantly contribute to the risk associated with groundwater use, as compared to the gross risks posed by organic contaminants. Manganese, the inorganic constituent that contributes the highest noncarcinogenic hazard due to ingestion of groundwater, only contributes 9.3% of the total hazard. Beryllium, the inorganic constituent which contributes the highest carcinogenic risk due to ingestion of groundwater, only contributes 5.1 % of the total carcinogenic risk. Therefore, the presence of inorganic constituents in groundwater has no impact what-so-ever on remedial decisions for the Malvern TCE Site.

Similarly, it must also be noted that there were no significant risks or hazards associated with direct exposure to site soils that resulted in a decision to remediate soil. The decision to remediate soil was based solely on the potential leaching of organic contamination from soil to groundwater. The proposed soil remediation methods are intended to address the soil-to-groundwater transport pathway, not direct contact with soil.

Specific comments related to the Former Disposal Area are addressed below:

- D** Contrary to ERM's claim, background metals were not evaluated on the basis of only one RI sample. All of the background soil samples collected at the Malvern TCE site were combined to calculate respective 95% UTL's for inorganic background constituents. The site-specific 95% UTL background concentration for each inorganic compound was then used to represent the background concentration for both Former Disposal Area and Main Plant Area soils. ERM further suggests that background metal concentrations at the Former Disposal Area were higher than those at the Main Plant Area. This assertion is also incorrect; background metal concentrations at the Former Disposal Area were not higher than at the Main Plant Area for the majority of the constituents which were detected.
- D** ERM questions the inclusion of arsenic as a COPC, citing that "16 of the 21 sample results were blank qualified." Arsenic was retained as a COPC because three of the 16 Former Disposal Area samples had detections of arsenic that were not blank qualified.

EPA risk assessment guidance (EPA, 1989) states that if all samples contain levels of a given constituent at five times (or 10 times for common laboratory contaminants) the level of contamination noted in the blank then that chemical should be completely eliminated from the set of sample results (Page 5-17, Section 5.5). Since arsenic was not blank-qualified in all of the analyzed samples it was rightfully retained as a COPC in the risk assessment.

- D The inclusion of cadmium as a COPC is challenged by ERM since only two of 10 samples contained cadmium in excess of the screening RBC for residential soil. However, cadmium was retained as a COPC because the maximum detected concentration in soil exceeded the background 95% UTL, as well as the RBC. Additionally, contrary to ERM's allegation, the risk assessment does not assume that chronic exposure will occur at only the most contaminated 10% of the soils. All confident detects and nondetects for cadmium at the Main Plant Area and Former Disposal Area are incorporated in the calculation of the exposure concentration.
- D ERM asserts that thallium should not have been identified as a COPC in soil since the highest detected concentration (3.1 mg/kg) was "not significantly above the non-detect at the background sample." Per EPA risk assessment policy, thallium was retained as a COPC because it was detected in on-site soil in excess of background, as well as in excess of its RBC.
- D ERM contends that even though aluminum was detected at noteworthy levels in soil, it should not have been evaluated in the risk assessment, since it is "one of the most abundant elements in the earth's crust. " As was discussed previously, it is current EPA policy to use site-specific background data, rather than background data from the general literature for the entire Eastern United States. Site-specific background data were collected at the Malvern TCE site. The concentration of aluminum detected at the site exceeded the 95% UTL for the site-specific background, as well as its RBC

Again, for the record, it must be noted that there were no significant carcinogenic risks or noncarcinogenic hazards associated with direct exposure to site soils that resulted in a decision to remediate the soil. The decision to remediate soil was based on the potential leaching of organic constituents from soil to groundwater. The proposed soil remediation methods are intended to address the soil-to-ground water transport pathway, not direct contact with soil. Therefore, ERM's comments on inorganic data handling are irrelevant to the proposed remediation.

#### Laboratory Artifacts

ERM asserts that defections of bis(2-ethylhexyl)phthalate (DEHP) in UST area surface soil are "laboratory artifacts, " citing a blank-qualified detection of 62,000 ug/kg as proof of this claim. However, DEHP observations that were not blank-qualified are an order of magnitude greater than the samples that were blank-qualified. The blank-qualified detection of DEHP cited by ERM (62,000 Ig/kg) actually represents a subsurface soil sample collected during a different sampling event than the confidently detected concentrations used in the risk assessment. Therefore, it is appropriate to assume that DEHP positively detected in surface soil is truly present on-Site and, therefore, eligible for risk-assessment consideration. (Note that DEHP contributed less than one percent of the total carcinogenic risk or noncarcinogenic hazard associated with exposure to UST area surface soil.)

ERM claims that chloroform is a "laboratory artifact" in several domestic wells and, therefore, should not have been evaluated in the risk assessment. Risk of exposure to chloroform was evaluated for several domestic wells because this organic contaminant was not detected in any of

the associated blank samples at similar concentrations during the RI sampling event. Similar concentrations of chloroform were considered blank-related for different sampling events on different sampling dates. Additionally, the wells where chloroform was the only COPC did not pose an unacceptable noncarcinogenic hazard or carcinogenic risk to potential receptors.

#### ERM Section 2.4.1.2, Receptors and Exposure Scenarios

Since the remedy for this Site involves extension of the public water supply, ERM believes evaluating groundwater risks in and around the Site, as was done in the risk assessment, is improper. However, the purpose of a baseline risk assessment is to evaluate current conditions at the Site, under the assumption that no remediation will be implemented, in order to determine the need for action. Presently at the Malvern TCE Site, neighboring residents are not connected to a public water supply and use groundwater as their sole potable source. Further, since groundwater flow is not confined by Site boundaries, future exposure to downgradient receptors can -- and will -- occur if contaminated groundwater is not addressed. Additionally, irrespective of current or potential future use patterns, groundwater is considered by the federal government to be a public asset and, as such, the National Contingency Plan mandates that groundwater be restored to its beneficial use to the extent practicable.

Given the objective of such evaluations, EPA makes a clear distinction between risk assessment and risk management. Using data founded in good science and conforming to EPA's mission of protecting public health and the environment, the risk assessment provides information on the potential threats associated with exposure to Site-related constituents. The risk manager uses this information to determine if clean-up is necessary and, if so, to help decide the best approach for remediation. Therefore, risks associated with potential potable groundwater use at the Malvern TCE Site have been provided in the risk assessment for application to risk management decisions. The technical and engineering issues related to Dense Non-Aqueous Phase Liquids and other remediation matters that could impact clean-up decisions are addressed in the Feasibility Study by the risk manager, not in the risk assessment by the risk assessor (as requested by ERM).

#### ERM Section 2.4.1.3, Data Set Used

ERM contends that an incomplete data set for off-site groundwater is provided in the RI report, and that EPA apparently used the highest historical concentration for each COPC to calculate risks from exposure. In response to this assertion, it should be noted that data from the June 1996 residential well sampling event were not available at the time the risk assessment was conducted. Therefore, data from 1995 were used in the assessment of risk. Although residential well sampling was performed on three occasions, no single residential well was sampled more than twice. Since a 95% Upper Confidence Limit can not be calculated from two sampling results, the maximum detection of the two samples was used as the exposure concentration in the risk assessment, per EPA guidance. For many of the wells, only one sample was collected during 1995; in this case, single sample results were used for risk assessment calculations, also in accordance with EPA guidance.

ERM disagrees with the inclusion of 1994 groundwater data for estimating Former Disposal Area risks. However, groundwater data collected from monitoring wells at the Chemclene property in both 1994 and 1996 were used for the assessment of risks at the Chemclene property. Use of the 1994 data, in conjunction with the 1996 results, may have resulted in a conservative risk estimate for the Former Disposal Area groundwater plume. However, use of the 1996 data alone would have also resulted in an unacceptable risk; triggering the need for action.

#### ERM Section 2.4.1.4, Quantitative Assessment of TCE and PCE

ERM challenges the inclusion of TCE and PCE in the risk assessment for the Malvern TCE Site, since carcinogenic slope factors for these compounds have been withdrawn from the Integrated Risk Information System (IRIS). Note, however, that rather than ignore potential risks posed by Site-related contaminants, it is standard risk assessment practice to use toxicity values which have been withdrawn from IRIS when no other values are available. The EPA National Center for Environmental Assessment (NCEA) recommends the use of the withdrawn slope factors for TCE and PCE as provisional values for risk assessment. Further, according to a June 8, 1993 memo from Cindy Sonich-Mullin (Director, Superfund Health Risk Technical Support Center, Chemical Mixtures Assessment Branch) to Edward Hanlon (U.S. EPA, Region V) on Toxicity Information for Trichloroethylene and Tetrachloroethylene (Fields Brook/OH), TCE and PCE were removed from IRIS in 1989 due to uncertainties in the cancer weight-of-evidence classification, not uncertainties in their carcinogenic slope factors. In addition, the World Health Organization has recently stated that TCE is probably carcinogenic to humans (IARC Monographs, 1995).

For the sake of perspective, it should be noted that TCE only contributes 16.4% of the inhalation and 12.8% of the ingestion cancer risk associated with potable use of Former Disposal Area groundwater, while at the Main Plant Area, TCE contributes 16.3% and 13.7% of the inhalation and ingestion cancer risks, respectively. PCE contributes an even lower percentage to the total risk associated with Former Disposal Area and Main Plant Area groundwater use. The primary contributor to carcinogenic risks via these exposure routes is 1,1-DCE. In fact, this compound alone poses an unacceptable cancer risk via either route of exposure (inhalation or ingestion), and is sufficient for triggering an action at the Site.

#### ERM Section 2.4.1.5, Evaluation of Other "Class C" Carcinogens

ERM erroneously interprets EPA's position on the evaluation of potential risks posed by possible human carcinogens, stating that such compounds "have inadequate evidence to be classified as carcinogens." In truth, EPA guidance indicates that slope factors are typically calculated for potential carcinogens in classes A, B1 and B2, and that estimation of slope factors for the chemicals in class C proceeds on a case-by-case basis. Further, EPA risk assessment guidance (USEPA, 1989) states that "slope factors for all potential carcinogens having a weight-of-evidence classification of A, B, or C should be sought" (Page 7-16, Section 7.4.3). Since slope factors are available for the class C carcinogens selected as COPCs in the Malvern TCE risk assessment, potential cancer threats presented by these contaminants were quantitatively evaluated in the risk assessment, as dictated by EPA guidance.

Further, EPA's proposed carcinogenic risk assessment guidelines (April 1996) discuss eliminating the use of weight-of-evidence classifications. If finalized in its current form, all class A, B and C carcinogens will be categorized into one group. Under this scheme, these constituents would still be evaluated for carcinogenic risks.

#### ERM Section 2.4.2.2, Contaminants of Potential Concern

In ERM's re-evaluation of risk at the Malvern TCE site, several "metals" were removed from consideration by "proper comparison" of concentrations to background levels, including "benz(a)fluoranthene and benzo(a)pyrene". Please note that neither benzo(a)fluoranthene nor benzo(a)pyrene are metals. Rather, these chemicals are semi-volatile organic compounds.

#### ERM Section 2.4.2.3, Reassessment of Site Risks

Completely dismissing all other contaminants at the Site, ERM calculated carcinogenic risk related only to vinyl chloride exposure. (Vinyl chloride is the only class A carcinogen detected at the Malvern TCE Site.) According to EPA risk assessment policy, it is improper to eliminate class B2 (or C) carcinogens from the calculation of carcinogenic risk for reasons cited above. EPA has conducted the Risk Assessment in accordance with good science, established science

and guidance, and with the important responsibility of protection of public health.

D. Comments of David DeWitt on behalf of the Concerned Residents of East Whiteland Township (CREW)

In a seven-page letter dated August 20, 1997, David DeWitt, President of CREW, submitted comments and questions on behalf of the group about EPA's proposed alternatives to cleanup the Malvern Site.

1. CREW is interested in the Community-Based Remedy Selection Process, part of the Superfund Administrative Reforms announced by Carol Browner, EPA Administrator, on October 2, 1995. CREW would like to be involved actively in all aspects of remedy selection and implementation. EPA proposed alternatives could make the community worse off than it is now if they are implemented. The alternatives should not put the interests of Chemclene before the interests and concerns of the community.

EPA Response: The Community-Based Remedy Selection Process Administrative Reform announced by Carol Browner is a pilot reform in which EPA, Region III did not participate. However, EPA intends to work closely with CREW in the implementation of the remedy to ensure the community's concerns are addressed during the Remedial Design. EPA understands the concerns that CREW may have with respect to remedy implementation but EPA is required by the NCP to protect public health in the selection of a remedy.

2. All structures, treatment units, etc., such as SVE wells and groundwater treatment units, should be located as far from residences as possible. Remedial activities and equipment should not be visible from Phoenixville Pike or Aston Road. All remedial activities should be carried out to minimize noise, dust, air emissions, odors, etc. in the area. Large equipment should be located inside buildings to minimize aesthetic and noise issues.

EPA Response: EPA understands the concerns of CREW and is committed to working with the community to address these concerns during the Remedial Design phase.

3. The developers of Aston Woods deeded the property bordered by Aston Road and Phoenixville Pike to East Whiteland Township as recreational land for the benefit of Aston Woods. This property should not be used for long-term remedial activities.

EPA Response: EPA understands the concerns of CREW but would like to reiterate that it may be necessary to use this property for long-term remedial activities. However, EPA is committed to working with the community and will consider their concerns in the Remedial Design phase.

4. EPA should place a RCRA cap over all areas where soil contamination is above relevant clean-up criteria. A RCRA cap is the only containment alternative that will minimize infiltration and prevent on-Site exposure during the O&M period and it is more protective of human health and the environment. The final remedy in the ROD should be contingent so that the parties carrying out the remedy have the option of implementing a RCRA cap.

EPA Response: The Selected Remedy for the cap construction at the Main Plant Area is performance based. This requires the cap to be constructed with the permeability equivalent to that of a RCRA cap. The performance standards for implementation of the cap are outlined on page 54 of the ROD.

5. EPA should eliminate the option of transporting contaminated soils from the Former

Disposal Area to the Main Plant Area because the movement could create uncontrolled air emissions of the contaminants in the soil. These soils either should be capped near the Former Disposal Area, but remote from homes, or transported off-Site. In addition, it is unfair and technically unwarranted to transport contaminated soil to create a containment cell 20- to 30-feet high directly behind homes.

EPA Response: EPA agrees that the contaminated soils at the Former Disposal Area should be transported off Site for treatment and disposal, and has provided for this in the Selected Remedy.

6. The SVE unit should treat off gases if detectable concentrations of site contaminants will be present in the off gases. There should be no injection of air or other vapors as part of the SVE since this may disturb subsurface air vapors unpredictably.

EPA Response: EPA has reconsidered the use of SVE at the Main Plant Area and has not selected SVE in the ROD.

7. EPA did not establish the technical feasibility of SVE. EPA should conduct pilot testing to ensure the technology is effective and appropriate. If SVE is implemented, the SVE well shown in the FS on or near the property line should be moved to another location.

EPA Response: EPA had planned a Pilot Study to determine the effectiveness of SVE but since it is not part of the Selected Remedy, EPA will not conduct a Pilot Study.

8. EPA has not given sufficient consideration to a natural attenuation groundwater remedy at the Main Plant Area. A groundwater pump-and-treat system will create a disturbance for the neighborhood and potentially can create an exposure pathway. EPA's scenario of an industrial worker at the Site drinking the water is not sufficient justification to pump and treat the groundwater since deed restrictions would eliminate this risk.

EPA Response: EPA disagrees. This comment is further addressed in Section C, #2 of this Responsiveness Summary. However, EPA did select Natural Attenuation at the Former Disposal Area.

9. If EPA implements a groundwater pump-and-treat system, the air stripper and all vapor-phase treatments must be located inside a building. The building should be noise proof and the system must have a noise arrester.

EPA Response: EPA understands the concerns of CREW and is committed to working with the community to address these concerns during the Remedial Design phase.

10. The groundwater treatment system should be located in the area identified as the proposed spray irrigation location. The system should not be located in close proximity to homes or directly across from Great Valley High School. CREW believes it impractical to have two separate groundwater treatment systems. If there is a treatment system for the Main Plant Area groundwater, there should be one consolidated system for the Main Plant Area and Former Disposal Area located away from homes. The inlet from the Former Disposal Area can be shut off after five years.

EPA Response: EPA has made a modification to the Proposed Remedy and has selected FDA-G-4, Natural Attenuation, for the Former Disposal Area groundwater. Therefore, it will not be necessary to construct a treatment system for the Former Disposal Area. EPA understands CREWs concern regarding the construction of a treatment system in the vicinity of the Main Plant and is committed to working with the community during the Remedial Design phase to address these concerns.

11. CREW strongly objects to the spray irrigation option for treated groundwater since it is likely to cause nuisance conditions from water spray drifting to homes, roads, etc., particularly in winter months when icing is a concern.

EPA Response: EPA has not selected Spray Irrigation for the discharge of treated groundwater.

12. EPA guidance states that treatment of DNAPLs is presumed to be technically infeasible and EPA is entitled to receive a technical impracticability (TI) waiver unless written justification to the contrary is provided. The proposed treatment will subject residences to greater pumping and extraction volumes and the extraction, handling, packaging, and transportation of listed hazardous wastes. CREW suggests selecting Alternative MPA-G-5 (Ground Water Collection, Treatment, and Discharge), and pumping and extraction rates should be determined based on a containment objective.

EPA Response: EPA has considered this issue in Section C, #2 of this Responsiveness Summary.

- E. Comments of Fox, Rothschild, O'Brien & Frankel, LLP and Walter B. Satterthwaite Associates Inc. on behalf of the Malvern De Minimis PRP Group

In a 17-page letter dated September 2, 1997, Fox, Rothschild, O'Brien & Frankel, LLP and Walter B. Satterthwaite Associates Inc., on behalf of the Malvern De Minimis PRP Group, submitted comments to EPA regarding the Proposed Plan.

1. The Malvern Site is a former RCRA facility and should be closed in accordance with RCRA guidelines. The Proposed Plan did not address normal RCRA closure issues which would eliminate any possible risk to human health for on-Site employees and future residents. Tailoring the clean-up plan to allow Chemclene to continue operating violates RCRA regulations.

EPA Response: The Selected Remedy addresses the closure of the regulated units (i.e. quonset hut and main building) that were never closed by Chemclene. Closure of the regulated units will not address the risk posed by soil and groundwater and EPA has deferred the remediation of the soil and groundwater to the Superfund program.

The remedy as established in the ROD will achieve all of the standards for closure under RCRA, even though the closure is done as part of a CERCLA cleanup. However, closure of a facility under RCRA does not require sealing off all access to the facility on which the RCRA units were located. It is not inconsistent with RCRA to allow Chemclene's continued use of the Site for activities which, do not require a RCRA permit.

The commentor in effect argues that there will be less risk of exposure to Chemclene workers if they are barred from the entire Site. Certainly there would be less theoretical risk at any Superfund site if a huge fence were constructed and all access to the site was forever forbidden. However, the purpose of CERCLA is to cleanup contaminated sites, not merely to reduce risk by restricting access. The cleanup of a Superfund site is to be designed, to the maximum extent practicable, to allow the continued or future use of the site and its resources.

2. EPA has ignored Land Use Guidance by allowing Chemclene to continue operating and in assuming residential use in the human health risk analysis. The guidance requires discussion with local land use authorities and other locally affected parties, review of anticipated future land use or uses, and zoning and analysis of site activities consistent with possible future land use.



EPA Response: EPA has not ignored the Land Use Guidance and has consulted with East Whiteland Township. The property is currently zoned residential and Chemclene currently operates a lawful nonconforming commercial facility from the property. This in effect means that the facility was in operation prior to the zoning and may continue to operate as such. It is clear from the zoning that the local land use authorities anticipate that the future land use could be a residential property.

3. EPA's policy is to defer facilities that may be eligible for inclusion in the Superfund program to the RCRA program if the sites are subject to RCRA corrective action. There are exceptions to this deferral, none of which are applicable in this situation. Chemclene is obligated to comply with RCRA.

EPA Response: EPA agrees that Chemclene should comply with RCRA generally speaking. The commentor argues that it is EPA policy to "defer facilities that may be eligible for inclusion in the CERCLA program to the RCRA program if they are subject to RCRA corrective action." However, EPA's RCRA deferral policies deal with the deferral of listing of a site on the NPL if it can be cleaned up under RCRA corrective action. These policies were not in effect in 1983 when the Malvern TCE Site was listed on the NPL. Notwithstanding the 1983 listing of the Site on the NPL, EPA continued to pursue cleanup of the Site under the RCRA corrective action regulations until 1993, when it became clear that Chemclene was neither willing nor financially able (based upon financial analysis at the time) to cleanup the Site expeditiously under RCRA. EPA's RCRA deferral policies are designed with two goals in mind. One goal is to preserve Superfund resources if a willing and able owner/operator is available to cleanup a site under RCRA. A second goal is to preserve the procedural rights of owners and operators to the extent that the owners/operators would prefer to continue work under RCRA in lieu of a listing on the NPL. Neither goal is at issue in the Malvern TCE Site. The owner/operator does not appear to have sufficient resources to cleanup the Site, and was unwilling to cooperate fully with the RCRA corrective action program.

EPA has to date undertaken only RI/FS activities at the Site, activities which are allowed under EPA's RCRA deferral policies even if a Site has not been listed on the NPL. Moreover, the proposed NPL listing was published in the Federal Register and both the owner/operator and the public have had sufficient opportunity to challenge the listing. At this time, 14 years after the Site was listed on the NPL, there are no procedural avenues left to address in the listing process.

Furthermore, the RCRA deferral policies simply do not address or imply a right of generators and other PRPs to demand that EPA use RCRA instead of CERCLA to cleanup the Site. One can easily see why the generator PRPs would prefer the cleanup to proceed under RCRA: under RCRA EPA can order only the owner and operator to conduct the cleanup, whereas generators also may be liable for a cleanup under CERCLA. However, the RCRA deferral policy is not in any way addressed to the generators' preferences. If the generators believe that the owner/operator should be responsible for the cleanup, the proper channel for such a claim is in a contribution suit against the owner/operator. Having determined that an expeditious cleanup is not likely to occur under RCRA, EPA's decision to utilize CERCLA is not subject to second-guessing by the generator PRPs. There are still obligations under both laws. The Agency retains discretion to decide which tools to use to accomplish the result.

4. The Malvern De Minimis PRP Group is extremely concerned about allowing Chemclene to continue operating on the Site. EPA appears to be assisting Chemclene in its continued operations by adjusting the selected remedy to allow Chemclene to stay in business. In doing so, EPA is allowing the very party EPA contends aided, and in some instances, caused the release of hazardous substances into the environment to operate on

the same land the company contaminated.

EPA Response: The commentor argues that an owner and operator who contributed to the contamination at a Site must necessarily be put out of business, or at least not be allowed to use any of the Site. However, absent extreme circumstances it has been EPA's policy to avoid putting PRPs out of business as a result of CERCLA liability. The commentor is misinformed; what would be unprecedented would be for EPA to require Chemclene to cease non-RCRA business activities merely because of Chemclene's liability for contamination at the Site. EPA has selected a remedy that is protective of human health and the environment which also allows continued use of the Site and its resources.

5. EPA's preferred alternatives neither meet the goals of nor are consistent with the management principles and expectations of the clean-up plan selection process described in the NCP.

EPA Response: EPA disagrees, and believes that both the Proposed Remedy and the Selected Remedy are consistent with the NCP. See Section IX and X of the Selected Remedy.

6. EPA's preferred alternatives likely will cause further migration of Site contaminants. The FS did not adequately consider the effects that the installation of a public water supply would have on human health. The FS failed to consider the fact that groundwater extraction, treatment, and reinjection is not more effective in protecting human health and the environment than natural attenuation.

EPA Response: Although EPA has reconsidered the extraction and treatment of groundwater at the Former Disposal Area and has selected Natural Attenuation, EPA disagrees with the conclusion that the preferred alternatives would cause further migration of the Site contaminants. ERM and Walter B. Satterthwaite Associates, Inc. (WBSA) both cited increasing VOC concentrations in time-related samples collected from pumping wells during the aquifer tests at the Former Disposal Area (CC-16 and CC-17), and Main Plant Area (CC-19 and CC-21) as evidence that pump and treat technology will contribute to plume migration at the Site. The increase in VOC concentrations from these samples provides strong evidence that pumping wells at both the Main Plant Area and Former Disposal Area should be successful in mobilizing and capturing contamination in groundwater at extraction wells. Using industry-accepted analytical modeling methods, the modeled pump and treat systems (pumping and injection wells) at both the Main Plant Area and Former Disposal Area were configured to contain the plume within the presently contaminated areas at the Site. These configurations were tested (using modeling methods) to ensure contamination could not migrate outside the cumulative capture zone for the system.

An evaluation of the effect of connecting residences to public water supplies for the Main Plant Area and Former Disposal Area in the FS indicated that alternatives MPA-G-3 and FDA-G-3, alone, were not protective of human health and the environment. Although residents would no longer use groundwater from beneath the area for drinking, or other domestic uses, contaminated groundwater could continue to migrate in the subsurface and potentially impact future residences. In the area around the Site, groundwater from the Ledger Aquifer is a source of high quality drinking water and in accordance with the NCP should be restored to beneficial use. As recently as 1992, Philadelphia Suburban Water Company withdrew water from this aquifer at a production well on Phoenixville Pike to supply local residents. In addition, Great Valley High School operated a well in the Ledger Aquifer to provide water for drinking and irrigation. Any alternative that allows highly contaminated groundwater to remain in an aquifer that has historically been utilized as a drinking water supply cannot be considered protective of human health and the environment.

Natural Attenuation cannot be considered protective of human health and the environment at the

Main Plant Area. With a natural attenuation alternative, groundwater contaminated with elevated VOC's is allowed to remain in an aquifer that has been historically used for drinking water supplies. In the best scenario, geochemical conditions (anoxic to hypoxic environment with anaerobic bacteria) are favorable for the destruction of CAH compounds to innocuous transformation products including water, carbon dioxide and chloride. If these conditions are not optimal as at the Main Plant Area, contaminants can persist in the groundwater indefinitely (in excess of 30 years). Even if geochemical conditions are favorable for the degradation of CAH's, some of the less halogenated, dechlorinated transformation products (vinyl chloride) that form as part of the natural attenuation process are considered more toxic than primary compounds (TCE, PCE). Groundwater pump and treat affords controlling migration of the contaminant plume and accomplishes removal of contaminant mass from the aquifer. Although ultimate aquifer restoration may not occur across the entire plume, contaminant mass is reduced and migration is limited to the property boundaries.

8. Soils in the vadose zone are characterized by highly heterogeneous, fine-grained soils. These soils significantly limit the effectiveness of SVE, indicating that, at a minimum, EPA should have conducted a treatability study to gauge adequately the technology's effectiveness at the site.

EPA Response: EPA has reconsidered the use of SVE as a remedial alternative for soil at the Main Plant Area. At the time of this decision, EPA has determined that the installation of the cap at the Main Plant Area will provide necessary protection of groundwater.

9. The distribution of substances detected in on-Site soils at the Main Plant Area is characterized by limited and isolated pockets with only trace levels of chemical outside these isolated hot spots. Therefore, EPA should evaluate alternatives which focus on the isolated and relatively shallow hot spots, with institutional and/or engineering controls for the remainder of on-Site soils which pose little or no long-term threat.

EPA Response: An evaluation at the Main Plant Area indicated that soil contamination as characterized by soil samples (contamination sorbed to soil particles) and vapor readings (soil gas) indicated that contamination occurred in three primary areas of concern (former underground storage tanks, aboveground storage tanks, and distillate condensate disposal area). Seventeen of the 42 subsurface samples analyzed at the Main Plant Area exhibited concentrations elevated above Site specific Soil Screening Levels (SSLs). EPA disagrees that contamination is relatively shallow, contamination in the vadose zone in all three areas extended to depths as great as 100 feet. Beneath each of these areas, concentrations and PID measurements were sufficiently elevated to suggest the presence of DNAPL, although DNAPL was never encountered in soil samples. EPA has, however, determined that engineering controls such as soil capping should provide adequate protection of groundwater, along with pump and treat.

10. The NCP states that, when groundwater restoration is not practical, EPA should ensure other protection to prevent the further migration of contaminants, prevent exposure to contaminated groundwater, and evaluate the need for further risk reduction. Data for the site indicates that this should be done. The proposed groundwater extraction alternative is likely to create additional contaminant migration beyond that which would occur naturally. The combination of hydrogeologic barriers and natural attenuation has prevented the plume from migrating. Therefore, groundwater extraction and treatment are not necessary or appropriate.

EPA Response: EPA agrees that groundwater pump and treat is not necessary at the Former Disposal Area and has reconsidered the implementation of this technology at the Former Disposal Area. Historical contaminant concentrations from groundwater samples have been declining since 1990 after removal of drums and contaminated soil at the Mounded Area. In addition, the presence of

significantly elevated concentrations of transformation products of TCE, PCE, and 1,1,1-TCA indicates that the natural attenuation processes are relatively advanced. In most of the monitor wells, concentrations of degradation products is equal to or greater than concentrations of primary CAH's.

However, EPA believes pump and treat technology is necessary and appropriate at the Main Plant Area. EPA believes that the extent of groundwater contamination at the Main Plant Area may not be fully defined. In addition, an evaluation of CAH concentrations indicates the process is not as advanced as it is at the Former Disposal Area. Total VOC concentrations in individual monitor wells have been stable since 1990. In addition, at many wells concentrations of less chlorinated transformation products are several times less than concentrations of primary CAH's. CAH concentrations in groundwater appear to be in equilibrium with a source in the vadose zone. Modeling simulations conducted using site-specific half-lives indicate that TCE is the most persistent CAH at the Main Plant Area and would require greater than 35 years to degrade below the MCL of 5 ug/l. A major assumption inherent to the degradation model equations is that contamination is in the aqueous phase and there is no DNAPL source replenishing degrading contaminants.

The use of pump and treat technology in the source area at the Main Plant Area is intended to reduce contaminant mass and prevent further migration from the Chemclene property. Time-related groundwater samples collected during the 24-hour aquifer tests at CC-19 and CC-21 indicate that extraction wells would be successful in mobilizing and collecting contaminants. Although, results of DNAPL screening utilizing several analytical techniques indicate that DNAPL may be present in the vicinity of CC-6, CC-7, and CC-13, visual evidence of DNAPL has never been encountered at the Site. The response to the pump and treat system in the suspected DNAPL area will be evaluated during the operation of the system. If it is determined through performance monitoring that it is impracticable to reach the cleanup standards, these standards will be changed in the DNAPL area.

11. During sampling conducted by EPA in May 1996, EPA found contaminant levels increased over a 24-hour period. The data indicates that pumping to obtain the samples caused significantly more plume migration in 24 hours than had occurred naturally in more than 15 years. This field test data indicates that the proposed alternative may actually be detrimental to human health and the environment.

EPA Response: EPA disagrees and believes the data shows otherwise. Many aspects of this comment have been addressed above.

12. The regional potentiometric surface map indicates that the elevation of the water surface surrounding the discontinuous plume is at an identical or higher elevation than the water surface at the Former Disposal Area. This area lies to the west of the flow path from the Former Disposal Area and another off-site source of contamination likely contributes to this condition. In addition, domestic well D-58, located in the center of the domestic well plume, contains no 1,1,1-trichloroethane (1,1,1-TCA) or 1,2-dichloroethane (1,2-DCA) two primary contaminants found in the plume at the Former Disposal Area in well CC-5.

EPA Response: This comment was already addressed in Section C, #1 above.

13. EPA calculated the rates of natural degradation at both the Main Plant Area and Former Disposal Area using half-lives calculated from historical site data for TCE and 1,1,1-TCA. Since the half-life values for these chemicals were based on actual site data, the degradation rates EPA calculated assume no source treatment. EPA did not consider, in either the FS or the Proposed Plan, the impacts of natural attenuation or marginal improvements in time to achieve Maximum Contaminant Levels (MCLs) under the

proposed alternative.

EPA Response: The time of attenuation for TCE and 1,1,1-TCA reported in the RI Report are based on the assumption that all contaminant mass is in the aqueous phase (assumption 1., page 5-39), and that there is no source (analytical equations in Table 5-3) to replace degrading CAH's. This evaluation essentially assumes that the source of contamination has been removed from each site. To maintain the conservativeness of the evaluation, CAH concentrations from the most contaminated wells were modeled for both sites (CC-5, Former Disposal Area; CC-7, Main Plant Area). In evaluating the present conditions at the site, these analyses are more valid for the Former Disposal Area than the Main Plant Area, where soils in the vadose zone appear to continue leaching contaminants to the groundwater. The intention of these analyses were to illustrate CAH degradation with time, under existing site conditions in the absence of a contaminant source.

WBSA's contention that remedial alternatives for groundwater (FDA-G-6, MPA-G-6) at the Former Disposal Area and Main Plant Area provide only marginal improvements in time to achieve MCL's is not valid. Evaluation of alternative FDA-G-6 indicates that with a combination of pumping at a single extraction well at 500 gpm for two years and natural attenuation all CAH's should degrade below their respective MCL's in 7 years from the beginning of remediation. Time of remediation using FDA-G-6 is significantly more rapid than for natural attenuation (FDA-G-4) which requires 16.5 years to achieve MCL's. Comparison of improvements for the time of remediation at the Main Plant Area between Alternatives MPA-G-4 and MPA-G-6 if all contamination in groundwater is in the aqueous phase. With dissolved phase contamination, concentrations should decline below MCL's in 19.5 years using alternative MPA-G-6. Assuming the source of contamination in the vadose zone is removed, contaminant concentrations should decline below MCL's in 35 years. However, a comparison of true improvements between alternatives is not valid if DNAPL is present. With DNAPL, pumping will continue for 30 years to reduce contaminant mass and prevent offSite migration. In the presence of DNAPL, natural attenuation will require significantly longer than 35 years to degrade below MCLs dependent on the strength of the source concentration.

14. Assuming public water is made available, which would reduce the risk of exposure to groundwater to zero, institutional controls preventing construction activities on the site would eliminate current and future risks.

EPA Response: Although the current risk of exposure to groundwater can be eliminated by connecting residents at both areas of concern to public water, this measure does not address leaving elevated concentrations of CAH's in the Ledger Aquifer. The Ledger Aquifer has been a historical source of high quality water supplies for residents in the area around the Malvern TCE area.

15. EPA rejected all technologies involving the excavation and ex-situ treatment of contaminated soil at the Main Plant Area because, in the FS, EPA determined that the contamination was too deep to be removed. EPA's conclusion was faulty because: (1) only two samples contained concentrations high enough to be considered a potential source of future groundwater degradation and (2) if the objective was to eliminate exposure of future construction workers, the depth of the soils posing a risk to these future workers certainly is not too deep to be excavated.

EPA Response: EPA disagrees and believes the facts show otherwise. WBSA's comments that only two subsurface soil samples collected at the Main Plant Area contained concentrations sufficiently high to be considered a potential source of contamination to groundwater is incorrect. Of the 42 subsurface soil samples (collected from 12 borings) submitted for laboratory analysis, 17 exhibited concentrations of one or more compounds in excess of the site specific SSL's (FS Appendix B, Table B4). Nine of the seventeen samples were collected at depths greater than 40 feet below grade. As the objective of excavation is to remove all contaminated soils with

concentrations greater than SSL's rather than selected easy-to-access areas, excavation of contaminated soil at the Main Plant Area was not considered practicable.

16. A significant concern for SVE at the Main Plant Area is heterogeneity of the subsurface soil, which could result in pockets of soil contamination that cannot be treated with SVE. The factors that caused EPA to reject soil flushing as a possible clean-up option would be just as detrimental to in-situ SVE. Therefore, consistent with the NCP, EPA should conduct a pilot scale treatability study. Therefore, EPA either should have rejected SVE or should not have rejected soil flushing during the preliminary screening process.

EPA Response: EPA has reconsidered implementation of an SVE alternative at the Main Plant Area. EPA believes that capping alone provides an equivalent level of protectiveness and long term effectiveness as SVE while being more cost effective. Prior to this decision a pilot study was planned for mid September that included a vacuum extraction well and four observation clusters. Although the alternative has been reconsidered, remediation with SVE could be effective at the Main Plant Area even in the presence of heterogeneous soils. The thick (around 70 feet) vadose zone at the Main Plant Area has been characterized by 12 borings. An additional five borings with continuous sampling would have been added or the pilot study.

Geologic interpretation of the vadose zone indicates that there are thick partly continuous zones of well sorted sands (RI Figures 3-3, 3-4, 3-5, 5-1 and 5-2) interbedded with silt and clay. Soil contamination as characterized by analytical results from soil samples and PID measurements indicates that contaminants occur in all lithology types at the Main Plant Area. Typically contamination in finer grained soils is found adjacent to a more permeable sand unit (Figures 4-3, 4-4, and 4-5). Contaminant distribution patterns in horizontal lithologic sections (RI Figures 5-1 and 5-2) indicate that contamination appears to have migrated through permeable units and collected at the interfaces marked by a lithologic change. By careful spacing of vapor extraction wells, air flow in the subsurface could be optimized to remediate contaminated soils in the highly permeable units and contaminant accumulations in proximal fine-grained soils.

Soilflushing was not considered equivalent to SVE in its ability to remediate soils at the Main Plant Area during the FS process because air is a significantly more effective carrier in the vadose zone than water (Fam, 1996). With SVE, air flow in the vadose could be more easily controlled than the flushing. Careful design of the SVE extraction well placement and screen intervals could take advantage of the heterogeneity at the Main Plant Area to develop an effective SVE system.

17. EPA should use caution when selecting gradient-control utilizing extraction wells to minimize DNAPL migration in groundwater. This is important particularly in the heterogeneous fractured carbonate aquifer where the direction of groundwater flow within individual water bearing units and the consequences of artificial gradient manipulation are impossible to predict. Using this technology likely would cause an increase in the mobility of contaminants which currently are contained by natural conditions.

EPA Response: Alternative MPA-G-6, using pump and treat technology to remove contaminants at the source area and downgradient areas of the plume at the Main Plant Area was designed to collect groundwater contaminants and prevent further downgradient migration. The mobilization of contaminants toward points of lower potentiometric head at extraction wells is not a valid argument for rejection of pump and treat technology. Mobilization of contaminants toward extraction wells as indicated by time-related sampling during pumping tests at the Main Plant Area and Former Disposal Area is the fundamental purpose of pump and treat technology. The system element of greatest concern in regard to migrating contamination is the injection well system, which could potentially drive contaminants away from the site. However, contaminants in the source area should not be affected by injection in downgradient areas of the site.

18. While EPA stressed that caution should be used to prevent DNAPL migration when evaluating containment, EPA did not consider this when evaluating collection and treatment, even though they are similar technologies in terms of the groundwater pumping process. Collection and treatment has been shown to cause contaminant migration within and between water bearing units in the aquifer, therefore EPA should reject it since it violates one of the RAOs.

EPA Response: See Response to E.17.

19. EPA did not consider innovative technologies to address groundwater contamination at the Main Plant Area, as stipulated in the NCP.

EPA Response: The hydrogeologic setting at the MPA, a fractured bedrock aquifer, is not compatible with a number of the new insitu, innovative technologies for groundwater remediation. As an example, WBSA recommendation for the use of an insitu reactor or reactor wall at the Main Plant Area is not feasible because there is no practical method for installing the reactive wall in the bedrock aquifer overlain by 40 to 100 feet of unconsolidated overburden. Injection of granular reactive iron through injection wells results in accumulation of this material in the bottom of the injection wells with no dissemination into the aquifer. New semi-passive well technologies (Wilson, et.al., 1997) utilizing reactive materials have not been implemented on actual Sites and have not been tested in bedrock environments. Most of these technologies were rejected before preliminary screening because they are not compatible with the hydrogeologic environment at the Site. This approach was selected rather than developing a long list of technologies that are quickly rejected in the screening task.

20. EPA incorrectly evaluated soils at the Former Disposal Area by inadequately reviewing gradient control and groundwater collection.

EPA Response: Comment E.20, derived from WBSA's comment 7, was somewhat confusing in relating gradient control and groundwater collection to the evaluation of soils remediation at the Former Disposal Area. The main intention of the comment appears to have been that gradient control at the Former Disposal Area was retained during the screening process (FS; Table 3-5), but considered impracticable because of high transmissivity in the Ledger Aquifer, while groundwater extraction was retained without mention of limitations. WBSA's cites this relationship as an inconsistency in the FS. Analytical flow and numerical transport modeling (FS; Appendix D) demonstrated that contaminants could be collected at relatively high flow rates with one to four extraction wells. However, gradient control and drawing the downgradient portion of the plume back toward the Former Disposal Area required even more elevated pumping rates from additional wells. As part of the single pumping-well collection alternative FDA-G-6; Appendix D), modeling indicated that a large portion of the contaminant plume would decouple from the Site and continue migrating downgradient, where it would naturally attenuate.

21. EPA stated that the effectiveness of SVE depends on the soil matrix, grain size, and moisture. However, the two areas with the highest contaminant concentrations at the Main Plant Area contain soils comprised of moist to wet silt and poorly graded sand with silt and clay. These soils types would inhibit SVE's effectiveness.

EPA Response: WBSA's comment regarding the moisture content of soils at the Main Plant Area and SVE effectiveness is noted as a concern for SVE. At present, EPA has reconsidered implementation of an SVE alternative (MPA-S-4) at the Main Plant Area. Alternative MPA-S-4 was, however, rejected because of concerns with the variable moisture content of subsurface soils. Moisture content of soils at the Main Plant Area varied across the potential area for SVE treatment. As an example, thick beds of well sorted sands encountered beneath the distillate condensate area

were dry and friable. An SVE pilot study was planned for the Site to help understand the effects of heterogeneities in lithology and moisture content. However, it is no longer necessary because an alternative remedy was chosen.

22. EPA concluded that pneumatic fracturing and thermal enhancements may increase the effectiveness of SVE if the future pilot study indicates that SVE is not effective. However, pneumatic fracturing will not provide significant benefits since it is best suited to brittle clays with low plasticity, conditions not present at the Site.

EPA Response: WBSA's comment regarding the feasibility of pneumatic fracturing at the Main Plant Area is noted; however, SVE is not currently planned for use at the Site.

23. The preliminary design for the SVE system assumes five extraction wells averaging 50 feet deep to capture contaminants over an area approximately 60 feet by 60 feet. This assumption is inconsistent with soil data collected during the RI.

EPA Response: At this time, EPA has reconsidered implementation of the SVE alternative at the Main Plant Area. However, contrary to WBSA's comment that the evaluation of soil lithology in FS Section 4.3.1.4 was incorrect, data show that thick beds of dry, well sorted sands underlie the potential area of treatment at the Main Plant Area (Figures 3-3, 3-4, and 3-5) as stated in the FS. This lithology was also described in the preliminary screening (FS Section 3.3.1.4). Subsequently, it is difficult to identify inconsistency in the FS regarding the description subsurface soils.

24. In terms of cost, EPA did not consider the possible need to alter the design of the SVE system, nor did EPA consider the cost of implementing another alternative if the SVE alternative does not work. In addition, Site data do not support the general conclusion that Site-wide treatment of soils is necessary.

EPA Response: WBSA's comment regarding cost analysis of alterations to SVE design or contingencies if SVE is not successful is noted. The actual design of the SVE system was to be based on the results of a comprehensive pilot study. Many of the design criteria for the system were to be developed from the pilot study. Subsequently, assumptions made for costing the FS might have changed.

25. EPA did not consider the combination of natural attenuation and public water adequately. EPA stated that the public water alternative would not provide for any reduction in the mobility of the groundwater plume. However, abandoning the existing wells will eliminate pathways for contaminant migration among individual water-bearing fractures in the residential wells. In addition, eliminating residential pumping will reduce the rate of future contaminant migration.

EPA Response: At present, EPA has reconsidered implementation of the groundwater pump and treat system at the Former Disposal Area (FDA-G-6). However, the discussion of public water supply and natural attenuation in the FS (Sections 4.3.4.3 and 4.3.4.5) was correct in stating that neither alternative was protective of human health and the environment. Although abandonment of local residential wells will prevent current exposure to contaminated groundwater, Alternatives FDA-G-3a and G-4, allow elevated concentrations of CAHs to remain in an aquifer that has been traditionally used as a source for high quality public drinking water supplies. The NCP considers groundwater a public asset that should be evaluated for restoration to beneficial use. With Alternatives FDA-G-3a and FDA-G-4, groundwater cannot be used for public consumption until natural attenuation meets health-based goals of MCLs.

26. Without any remedial measures having taken place, the contaminant plume has migrated



less than 150 feet. For dissolved-phase VOCs in a highly transmissive fractured carbonate bedrock aquifer, this is an extremely rare occurrence. This clearly demonstrates that natural attenuation processes are effective in controlling contaminant migration in groundwater at the Main Plant Area. Because natural attenuation has been proven to demobilize VOCs in groundwater and cause a reduction in the volume and toxicity of the contaminant plume, natural attenuation satisfies several of the RAOs for groundwater at the Main Plant Area.

EPA Reponse: EPA does not believe the full extent of the VOC contaminant plume in groundwater at the Main Plant Area has been fully characterized. The RI report documented groundwater flow from the Site to the northeast. The monitoring wells located off the Chemclene property are located east of the Site. The evidence suggests that the low VOC concentrations seen in these monitoring wells may be due to lateral dispersion, not natural attenuation, and the longitudinal axis of the VOC plume may be oriented to the northeast. The extent of contamination in this direction will be determined during the remedial design phase.

The mechanism and nature of CAH degradation in groundwater at the Main Plant Area is uncertain. Groundwater beneath the Main Plant Area is oxic (dissolved oxygen > 2.0 mg/L), and subsequently not compatible with the dechlorination and dehalogenation of CAHs by biodegradation. Degradation of CAHs is typically associated with anaerobic bacteria in an hypoxic to anoxic environment (Barbee, 1994). An evaluation of the concentrations of primary CAHs (TCE, PCE, 1,1,1-TCA) in relation to dechlorinated transformation products (cis 1,2-DCE, vinyl chloride, 1,1-DCE, etc.) suggests that the progress of degradation is not advanced. Furthermore, the constituent ratios of transformation products to primary products are not increasing with time as expected at a Site where contaminant concentrations and migration is controlled by natural attenuation. An evaluation of concentration ratios conducted along the centerline of the plume using data from May 1996 indicates that ratios of transformation products to primary CAHs remain stable with distance from the contaminant source area (RI Figure 5-9). These concentration relationships would suggest that whole scale natural attenuation is not occurring in groundwater at the Main Plant Area.

27. Using the proposed groundwater collection, treatment, and discharge system, EPA estimated that, assuming source control or removal, the contaminant plume will be remediated below MCLs in 19.5 to 32.5 years, depending on the success of the hydrofracturing. This assumption is incorrect for three reasons: (1) available data indicate that pumping caused a significant migration of the plume; (2) hydrofracturing may cause contaminants to migrate into new water-bearing units not previously intercepted and could alter the hydrogeologic characteristics naturally containing the plume; and (3) the time frame estimate for remediation is based on the unrealistic assumption that DNAPLs are not present.

EPA Response: EPA disagrees and believes that the facts demonstrate otherwise. This response is based on WBSA's previous comment that contains three reasons that assumptions for estimating time of remediation for alternative MPA-G-5 were flawed. On the contrary, estimates of the time of remediation for the contaminant plume at the Main Plant Area were correct based on the assumption that contaminants were in the dissolved phase. In direct contradiction to WBSA's previous comment, the FS (Section 4.3.2.5) clearly states that additional pumping time would be required for a DNAPL source below the water table.

As stated in earlier responses, mobilization of contaminants toward pumping wells as demonstrated during the 24-hour pumping tests, is not an indication that implementation of pump and treat technology causes additional migration of the contaminant plume. As indicated in the RI, time-related sampling results from the pumping tests indicate that contaminants can be mobilized and captured at extraction wells. Hydraulic fracturing at the Main Plant Area is

intended to increase extraction well performance (specific capacity, yield, efficiency, etc ) by propagating fractures into the rock matrix and limit the influence of diffusion on remediation. Increasing fracture aperture and propagating fractures into the rock benefits the performance of an individual extraction well and ultimately the entire, extraction well system. Subsurface investigations at the Main Plant Area to date have not indicated that the Ledger Aquifer is separated into discrete aquifer zones whose integrity would be compromised by the propagation of fractures.

28. Public water combined with natural attenuation is the only appropriate remedy. Natural attenuation ensures that no further migration of the contaminant plume will occur.

EPA Response: EPA disagrees and believes the NCP suggests a different answer. Comment E26 addresses concerns about using only public water supply (WS-G-3a) and natural attenuation (MPA-G-4) for the remediation of groundwater at the Main Plant Area. EPA has reconsidered the implementation of a pump and treat alternative (FDA-G-6) at the Former Disposal Area and will rely on public water supply and natural attenuation for remediation of the contaminant plume at the Former Disposal Area. Importantly, EPA has concluded that both these choices satisfy the key goal of protection of public health.

29. EPA assumed that the cap at the Former Disposal Area will be effective in eliminating the risk of direct contact with soils, but if the cap is damaged, a plume of contaminated groundwater caused by leaching could be reactivated. This assumption is incorrect because, since the early 1980s, natural attenuation has resulted in the contraction of the contaminant plume.

The intent of this comment is noted. However, a break in a cap at the Former Disposal Area could result in a relative increase in contaminant concentrations in groundwater. Based on evaluations of historical analytical data, increasing concentrations due to loss of cap integrity should cause only a brief increase in concentrations above, levels at the time of the break.

30. Not only has the groundwater plume at the Former Disposal Area been contained, but it has been contracting for several years. Therefore, natural attenuation provides a higher degree of short-term effectiveness. Since there appear to be no DNAPLs present at the Former Disposal Area, the length of time required to achieve MCLs in the Former Disposal Area plume likely will be significantly shorter than at the MPA. Since the contaminated soil area at the Former Disposal Area has not had an adverse impact on water quality, vadose zone source removal or control is not critical. Eliminating the risks associated with direct contact with soils, combined with public water and natural attenuation, could be a cost effective combination of alternatives that meet the RAOs and ARARs for soils and groundwater at the Former Disposal Area.

EPA Response: EPA has reconsidered implementation of groundwater extraction and treatment remedial alternative (FDA-G-6) at the Former Disposal Area and has decided to choose natural attenuation. An evaluation of historical analytical data at the Former Disposal Area indicates that the rate of decline in constituent concentrations has decreased over the last two sampling events (May and December 1996). A portion of this trend is shown in Figure 5-5 of the RI Report, where total concentrations of 1,1,1-TCA, TCE, and PCE were close to historical maxima in monitor wells CC-5 and CC-10. The decrease in the rate of CAH degradation may indicate that contaminants in groundwater are reaching equilibrium with residual contamination in the vadose zone. If time-related concentrations in groundwater reach steady state, the ultimate time of attenuation may increase. Estimates of time of attenuation performed during preparation of the RI Report were based on Site-specific degradation rate constants calculated during a period of plume recession. If concentrations become stable with time, rate constants will become smaller, and

the original estimates for duration of attenuation will have been under estimated.

Remediation of soil in the vadose zone at the Former Disposal Area will help enhance the natural attenuation process. Removal of residual contamination should result in another episode of plume recession and ultimately the degradation of contaminant concentrations below MCL's.

F. Comments of the National Park Service division of the United States Department of the Interior

In an undated two-page letter, E. Scott Kalbach, Acting Superintendent of Valley Forge National Historical Park, submitted comments on behalf of the Valley Forge National Historical Park, part of the National Park Service division of the U.S. Department of the Interior. Mr. Kalbach submitted comments to EPA regarding the Proposed Plan for the Malvern TCE Site.

1. Chemicals and metals from the Malvern Site have the potential to contaminate surface water draining into Valley Creek. The Proposed Plan does not include any mitigating actions for Valley Creek, which is an Exceptional Value waterway and a Class A Wild Trout Stream.

EPA Response: Based on the results of the RI, EPA has concluded that the contaminants of concern at the Malvern Site are generally VOCs and in one area, low levels of PCBs. EPA has sampled surface water closest to the source areas on the Chemclene property and in Valley Creek and has concluded that contaminants from the surface water at the Site have not impacted Valley Creek. Additionally, VOCs are not detected by the time groundwater from the Site discharges to Valley Creek. However, as part of the Selected Remedy, the groundwater contaminant plume in the vicinity of the Former Disposal Area will be monitored to ensure that Valley Creek is not impacted in the future.

2. Collection of baseline data may be necessary to develop standards for measuring changes over time in water chemistry and the aquatic biological community.

EPA Response: During the ecological field evaluation the benthic community directly found on the Site, in the area of highest contamination, was not found to be impaired. In fact, the benthic community was found to be productive and healthy. In addition, toxicity tests conducted with benthic organisms indicated no adverse effects in any sediment samples collected from the Site in the area of highest contamination. Therefore, there is no indication or justification for evaluating other areas which are likely to be less contaminated and for which we can make no causal link to the Site as the source.

3. EPA's failure to address Valley Creek in the Proposed Plan is the result of a deficient Ecological Risk Assessment in the RI Report. EPA investigators visited the Malvern Site to test Valley Creek On June 20, 1995, a day when there was no water in the creek. Therefore, investigators took no samples of water, sediments, or microorganisms.

EPA Response: Valley Creek was sampled in the Ecological Risk Assessment and was found to have TCE concentrations just above detection limits. The Ecological Risk Assessment utilizes a gradient approach to sampling. By gradient, samples are collected which represent a range of concentrations known (by literature review) to potentially cause adverse effects. Since Valley Creek was just above non-detection, it did not represent a potential issue in the Ecological Risk Assessment and other sampling locations with elevated concentrations of Site contaminants were evaluated intensely. The theory here, is that the concentrations which cause adverse effects are identified. Near non-detect values did not result in adverse effects, thus Valley Creek was not at risk.

4. A more complete biological survey would have revealed that a few years ago a bog turtle, proposed for federal listing as a threatened species, was discovered in this wetland and the a state-listed endangered plant, the possum haw was found on a nearby hillside.

EPA Response: This was an oversight in the biological survey. However, this wetland is not located at the Site and incomplete exposure pathways appear to be associated with both of these species.

6. EPA did not consider the possibility that the cone of depression from dewatering at Catanach Quarry may interfere with the contamination plume from the Malvern Site. Although Catanach Quarry currently discharges into a sinkhole, the Quarry may request permission from PADEP to discharge to Valley Creek after Warner Quarry closes.

EPA Response: EPA is aware of the cone of depression from the Catanach Quarry and discusses this in the RI and the ROD.

7. Two other Superfund Sites exist in the Valley Creek watershed: Foote Mineral and Paoli Rail Yard. In addition, Knickerbocker Landfill, now closed due to illegal hazardous waste dumping, is located nearby. EPA did not consider the combined effects of these Sites on Valley Creek as part of the environmental risk assessment of the Malvern Site.

EPA Response: The purpose of the Ecological Risk Assessment was to evaluate potential ecological impacts of the Malvern TCE Site. Ecological Risk Assessments are Site specific and are developed for all Superfund Sites. As stated above in response #1, EPA believes that the data show that the Valley Creek has not been impacted by the Malvern TCE Site. Therefore, the combined impacts of Malvern TCE with other sites in the area is beyond the scope of the Superfund program.

#### G. Comments of a North Phoenixville Pike Couple

In a one-page letter dated August 27, 1997, a couple living on North Phoenixville Pike submitted comments regarding the Proposed Plan to cleanup the Malvern Site.

1. Although EPA stated that the connection of residences to the public water supply is, at this stage, a proposed alternative, there are stakes on residential properties for the purpose of installing the water lines. It seems that the decision to provide public water already has been made. In addition, the layout of the water lines does not coincide with the property lines.

EPA Response: The current construction activity is being conducted exclusively by the Philadelphia Suburban Water Company and is independent of EPA's Selected Remedy.

2. Although the couple agrees with EPA's decision to provide public water to residents with contaminated wells, the couple believes that the public water Supply currently is more contaminated than their well. As a precaution against possible contamination, this couple installed and has maintained a carbon filter on their well since 1980, at their own expense. This couple does not wish to be connected to the public water supply.

EPA Response: EPA has selected the provision of a public water supply for the homes impacted or potentially impacted by the Site. Groundwater use for human consumption is prohibited once the public water supply is implemented EPA beleives the public water supply is more protective and reliable than the continued use of home wells.

3. This couple will not decommission their well. Their 19-acre property is protected by Act 319 (Clean and Green Program) and supports young Christmas trees, fruit trees, soft

fruits, asparagus, and vegetables. The couple wishes to keep their well for agricultural purposes.

EPA Response: The remedy prohibits use of groundwater for human consumption. In addition any future groundwater use should not interfere with EPA's selected remedy. From EPA's perspective groundwater use for irrigation purposes that does not interfere with the migration of contamination from the Former Disposal Area or the Main Plant Area would be acceptable. However, there are state and county regulations which may prohibit such use. This issue will be addressed during remedial design.

4. The property located at 218 Phoenixville Pike currently is vacant. Although the house that formerly occupied the property was torn down, the well (formerly on a filter) and electric utilities remain. If a public water main is brought down Phoenixville Pike, the property at 218 Phoenixville Pike should be connected because the possibility for future occupancy remains.

EPA Response: Connections to the public water supply will only be made for current residences.

#### H. Comments of the Pennsylvania Environmental Defense Foundation

In a one-page letter dated August 25, 1997, Chuck Marshall Chair of the Pennsylvania Environmental Defense Foundation, submitted comments regarding the Proposed Plan to cleanup the Malvern Site.

1. The Pennsylvania Environmental Defense Foundation supports EPA's preferred alternative. OffSite Excavation and Treatment appears more costly while only marginally more effective than the preferred alternative. Anything other than soil vapor extraction, capping, and pump-and-treat does not appear to reduce the plume and the contamination.

EPA Response" EPA has made modifications to Proposed Remedy in the final Selected Remedy which EPA believes provides an equivalent level of protectiveness and cost effectiveness.

2. EPA does not appear to have evaluated the impact of the injection and withdrawal wells on Valley Creek. EPA should ensure that neither surface water runoff nor groundwater flow impact the creek.

EPA Response: The Selected Remedy for the groundwater at the Former Disposal Area is Natural Attenuation. Therefore, there is no impact to Valley Creek from a pump and treat system. EPA has responded above in F.1 regarding any impact to Valley Creek from the Site contamination.